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Butte Falls Resource Area

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Timbered Rock Fire Salvage and Elk Creek Watershed Restoration Final Environmental Impact Statement

Volume II - Appendices

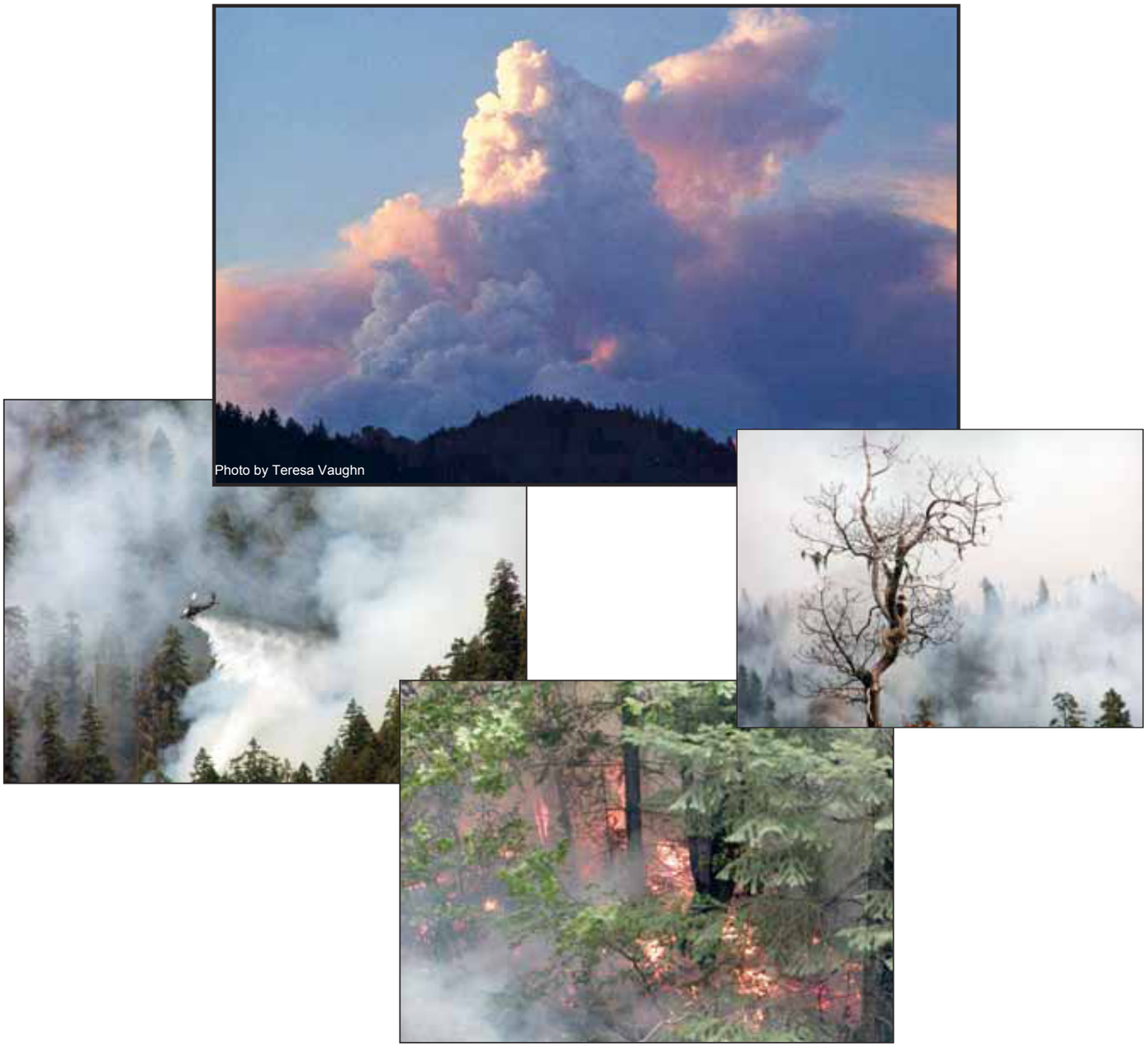
Photo by Teresa Vaughn

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interest of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

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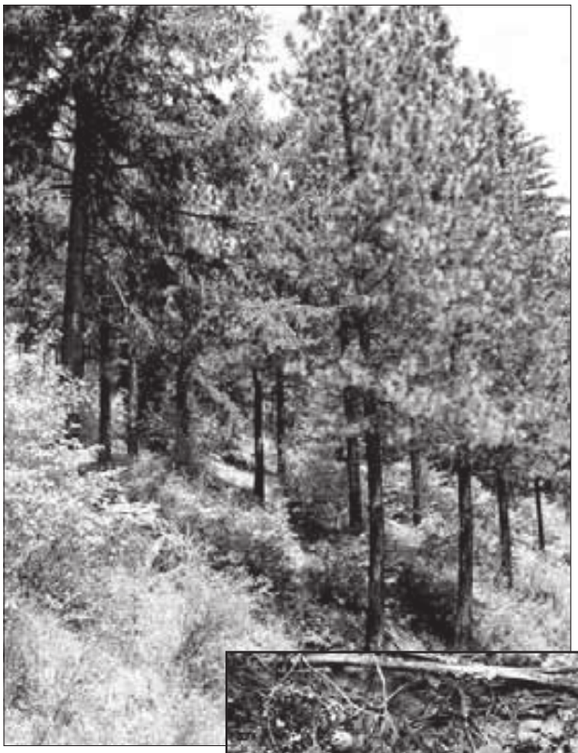
Appendices



Changes Between the Draft and Final EIS

The following changes were made to the Appendices between the Draft and Final EIS. Minor corrections, explanations, and edits are not included on this list.

- Appendix B: Chapter 4 from the South Cascades LSRA (Desired Future Conditions) has been added.
- Appendix D: Depictions of area salvage treatments using Stand Visualization System (SVS) have been added for Alternatives A through F and area salvage and research units in Alternative G.
- Appendix D: Snag and CWD levels by units for Alternative D have been added.
- Appendix D: A table showing salvage units and harvest units for Alternative G has been added.
- Appendix E: Slight changes have been made to proposed restoration projects for Fisheries, Late-Successional Forest Habitat, Pine Habitat, Reforestation, and Reforestation Research.
- Appendix G: Both research proposals (influences of salvage and salvage intensity on wildlife and mixed-species plantations and fire restoration) have been updated.
- Appendix I: The Water Quality Restoration Plan (WQRP) has been completed and included.
- Appendix J: Information has been added regarding consultation with NOAA-Fish.
- Appendix K: Table K-1 has been modified and some of the information has been included in Table 2-4. Table K-2 has been dropped.
- Appendix L: Botany information has been updated to reflect information gathered from 2003 surveys and to update status of plants within the project area.
- Appendix N: Tables related to northern spotted owls have been updated to reflect surveys completed in 2003 (Table N-3) and background data for effects analysis (Tables N-4 through N-9).
- Appendix N: Three new sections related to northern spotted owl were added; 1) cover memorandum dated July 14, 2003, 2) excerpts from the recently completed Biological Opinion, and 3) life history summaries.
- Appendix N: Results of 2003 Great Grey Owl, goshawk, bat, and pond turtle surveys were included.

Appendices

Appendix A ..... LSR Guidance from Northwest Forest Plan ROD (Pages C-9 to C-21) and REO Memorandums
Appendix B ..... South Cascades Late-Successional Reserve Assessment Chapters 3, 4, and 5
Appendix C ..... Management Recommendations from the Elk Creek Watershed Analysis
Appendix D ..... Salvage
Appendix E ..... Proposed Restoration Projects
Appendix F ..... Report on Fires and Post-Fire Management Effects
Appendix G ..... Research Proposal
Appendix H ..... Soil
Appendix I ..... Hydrology
Appendix J ..... Fisheries
Appendix K ..... Vegetation
Appendix L ..... Botany
Appendix M ..... Fuels
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Appendix O ..... Roads

Appendix A
LSR Guidance from Northwest Forest Plan ROD
Pages C-9 to C-21
and REO Memorandums

C. Standards and Guidelines

Late-Successional Reserves

Acres

Key and non-Key Watersheds are specified for all areas, and therefore overlay all other land allocations. For the portion of Late-Successional Reserves located within Key Watersheds, standards and guidelines for Key Watersheds (see Key Watersheds on page C-7, and the Aquatic Conservation Strategy starting on page B-9 of these standards and guidelines), as well as standards and guidelines for Late-Successional Reserves (listed below) apply. See additional detail under Hierarchy of Standards and Guidelines on page C-1.

Late-Successional Reserves within Tier 1 Key Watersheds 3,151,700
Late-Successional Reserves within Tier 2 Key Watersheds 279,100
Late-Successional Reserves within non-Key (other) Watersheds..... 4,000,000
Total Late-Successional Reserves 7,430,800

Acreage of Riparian Reserves is not calculated within Late-Successional Reserves for these standards and guidelines. However, Riparian Reserve standards and guidelines affect approximately 40 percent of Late-Successional Reserves.

Description

The objective of Late-Successional Reserves is to protect and enhance conditions of late-successional and old-growth forest ecosystems, which serve as habitat for late-successional and old-growth related species including the northern spotted owl.

Late-Successional Reserves have been designated based on five elements: (1) areas mapped as part of an interacting reserve system; (2) LS/OG 1 and 2 areas within Marbled Murrelet Zone 1, and certain owl additions, mapped by the Scientific Panel on Late-Successional Forest Ecosystems (1991); (3) sites occupied by marbled murrelets; (4) known owl activity centers; and (5) Protection Buffers for specific endemic species identified by the Scientific Analysis Team (SAT)(1993). Additional areas, such as 600 acres around known sites of fungus species *Oxyporous nobilissimus*, are protected under the survey and management standards and guidelines starting on page C-4 of these standards and guidelines. Details are as follows.

1. Mapped Late-Successional Reserves

Most Late-Successional Reserves are mapped areas, shown on the Alternative 9 map that was included with the Final SEIS and described on page A-6 of these standards and guidelines. They were designed to incorporate Key Watersheds to the extent possible, while remaining consistent with other objectives. They also incorporate some or parts of LS/OG1s and LS/OG2s (most ecologically significant, and ecologically significant late-successional and old-growth forests, respectively, from the Scientific Panel on Late-Successional Forest Ecosystems [1991] and some or parts of the Designated Conservation Areas (DCAs) from the Final Draft Spotted Owl Recovery Plan in the western portion of the range of the northern spotted owl.

2. LS/OG 1s and 2s

Also shown on the Alternative 9 map, all LS/OG1s and LS/OG2s within Marbled Murrelet Zone 1, except in the Quinault Special Management Area, are Late-Successional Reserve, as are owl additions mapped by the Scientific Panel on Late-Successional Forest Ecosystems (1991) within the Finney and Northern Coast Adaptive

Management Areas. Where LS/OG status is used to define the boundaries of a Late-Successional Reserve, the boundaries are fixed regardless of the future condition of those (or other) stands.

3. Occupied Marbled Murrelet Sites

The area close to marine environments associated with most marbled murrelet activity is referred to as Marbled Murrelet Zone 1. Zone 1 extends approximately 40 miles inland in Washington, 35 miles inland in Oregon, 25 miles inland in California north of Fort Bragg, and 10 miles inland south of Fort Bragg. Zone 2 is defined for survey purposes and does not affect land allocations. Both Marbled Murrelet Zones 1 and 2 are shown on the Alternative 9 map that was included with the Final SEIS. However, for survey purposes only, some portions of these zones are being remapped to be consistent with the above description. (See also page A-6. This remapping does not LS/OGs reserved under #2 above.)

Preproject surveys of marbled murrelet habitat are required according to protocol currently used by the federal agencies. Current protocol requires 2 years of surveys to assure that no marbled murrelet nests exist in areas planned for timber harvest. If behavior indicating occupation is documented (described below), all contiguous existing and recruitment habitat for marbled murrelets (i.e., stands that are capable of becoming marbled murrelet habitat within 25 years) within a 0.5-mile radius will be protected. The 0.5-mile radius circle should be centered on either the behavior indicating occupation, or within 0.5 mile of the location of the behavior, whichever maximizes interior old-growth habitat. When occupied areas are close to each other, the 0.5-mile circles may overlap.

Behavior indicating marbled murrelet occupation includes at least one of the following: (1) discovery of an active nest or a recent nest site as evidenced by a fecal ring or eggshell fragments; (2) discovery of a chick or eggshell fragments on the forest floor; (3) birds flying below, through, into, or out of the forest canopy within or adjacent to a stand; (4) birds perching, landing, or attempting to land on branches; (5) birds calling from a stationary location within the stand; (6) birds flying in small or large radius circles above the canopy.

4. Known Spotted Owl Activity Centers

This standard and guideline applies to known spotted owl activity centers that are not protected by Congressionally Reserved Areas, Late-Successional Reserves, Riparian Reserves, Managed Late-Successional Areas, or Administratively Withdrawn Areas. One hundred acres of the best northern spotted owl habitat will be retained as close to the nest site or owl activity center as possible for all known (as of January 1, 1994) spotted owl activity centers located on federal lands in the matrix and Adaptive Management Areas. This is intended to preserve an intensively used portion of the breeding season home range. “Activity center” is defined as an area of concentrated activity of either a pair of spotted owls or a territorial single owl. Timber management activities within the 100-acre area should comply with management guidelines for Late-Successional Reserves. Management around this area will be designed to reduce risks of natural disturbance. Because these areas are considered important to meeting objectives for species other than spotted owls, these areas are to be maintained even if they become no longer occupied by spotted owls.

5. Protection Buffers

Unmapped Late-Successional Reserves result from the application of Protection Buffers (see standards and guidelines below).

Standards and Guidelines

Also see Standards and Guidelines Common to all Land Allocations starting on page C-2 of these standards and guidelines.

Objectives - Late-Successional Reserves are to be managed to protect and enhance conditions of late-successional and old-growth forest ecosystems, which serve as habitat for late-successional and old-growth related species including the northern spotted owl. These reserves are designed to maintain a functional, interacting, late-successional and old-growth forest ecosystem. See additional information in the Ecological Principles for Management of Late-Successional Forests discussion in Section B of these standards and guidelines.

Exceptions - Research Natural Areas and activities required by recovery plans for listed threatened and endangered species take precedence over Late-Successional Reserve standards and guidelines.

Management Assessment for Late-Successional Reserves - A management assessment should be prepared for each large Late-Successional Reserve (or group of smaller Late- Successional Reserves) before habitat manipulation activities are designed and implemented. Land management agencies may choose to develop these assessments as components of legally-mandated plans (e.g., Forest or District Plans), as part of province-level planning, or as stand-alone assessments. If developed to stand alone, the assessments should be closely coordinated with subsequent watershed analysis and province-level planning. Standards and guidelines should be refined at the province level, prior to development of Late-Successional Reserve assessments. Late-Successional Reserve assessments should generally include: (1) a history and inventory of overall vegetative conditions within the reserve, (2) a list of identified late-successional associated species known to exist within the Late-Successional Reserve and information on their locations, (3) a history and description of current land uses within the reserve, (4) a fire management plan, (5) criteria for developing appropriate treatments, (6) identification of specific areas that could be treated under those criteria, (7) a proposed implementation schedule tiered to higher order (i.e., larger scale) plans, and (8) proposed monitoring and evaluation components to help evaluate if future activities are carried out as intended and achieve desired results. Only in unusual circumstances would silvicultural treatments, including prescribed fire, precede preparation of this management assessment. Late-Successional Reserve assessments are subject to review by the Regional Ecosystem Office. Until Late-Successional Reserve assessments are completed, fire suppression activities should be guided by land allocation objectives in coordination with local resource management specialists.

Occupied Marbled Murrelet Sites - Timber harvest is prohibited within occupied marbled murrelet habitat at least until completion of the Marbled Murrelet Recovery Plan. Silvicultural treatments in non-habitat within the 0.5-mile circle must protect or enhance the suitable or replacement habitat. When objectives of the Marbled Murrelet Recovery Plan have been identified, management direction will be amended or revised as appropriate.

Silviculture

Thinning or other silvicultural treatments inside reserves are subject to review by the Regional Ecosystem Office to ensure that the treatments are beneficial to the creation of late-successional forest conditions. The Regional Ecosystem Office may develop criteria that would exempt some activities from review. Stand and vegetation management of any kind, including prescribed burning, is considered a silvicultural treatment. Excepted from review are reforestation activities legally required by, and planned as part of, existing sold timber sales, where the reforestation prescription has been modified as appropriate to meet the objectives of the Late-Successional Reserve.

Activities permitted in the western and eastern portions of the northern spotted owl's range are described separately below. Salvage of dead trees is described separately below, and is limited to stand-replacing disturbance events exceeding 10 acres.

West of the Cascades - There is no harvest allowed in stands over 80 years old (110 years in the Northern Coast Adaptive Management Area). Thinning (precommercial and commercial) may occur in stands up to 80 years old regardless of the origin of the stands (e.g., plantations planted after logging or stands naturally regenerated after fire or blowdown). The purpose of these silvicultural treatments is to benefit the creation and maintenance of late-successional forest conditions. Examples of silvicultural treatments that may be considered beneficial include

thinnings in existing even-age stands and prescribed burning. For example, some areas within Late-Successional Reserves are actually young single-species stands. Thinning these stands can open up the canopy, thereby increasing diversity of plants and animals and hastening transition to a forest with mature characteristics.

East of the Cascades and in the Oregon and California Klamath Provinces - Given the increased risk of fire in these areas due to lower moisture conditions and the rapid accumulation of fuels in the aftermath of insect outbreaks and drought, additional management activities are allowed in Late-Successional Reserves. Guidelines to reduce risks of large-scale disturbance are as follows:

> Guidelines to Reduce Risks of Large-Scale Disturbance - Large-scale disturbances are natural events, such as fire, that can eliminate spotted owl habitat on hundreds or thousands of acres. Certain risk management activities, if properly planned and implemented, may reduce the probability of these major stand-replacing events. There is considerable risk of such events in Late-Successional Reserves in the Washington and Oregon Eastern Cascades, and California Cascades Provinces and a lesser risk in the Oregon and California Klamath Provinces. Elevated risk levels are attributed to changes in the characteristics and distribution of the mixed-conifer forests resulting from past fire protection. These forests occur in drier environments, have had repeated insect infestations, and are susceptible to major fires. Risk reduction efforts are encouraged where they are consistent with the overall recommendations in these guidelines.
>
> Silvicultural activities aimed at reducing risk shall focus on younger stands in Late-Successional Reserves. The objective will be to accelerate development of late-successional conditions while making the future stand less susceptible to natural disturbances. Salvage activities should focus on the reduction of catastrophic insect, disease, and fire threats. Treatments should be designed to provide effective fuel breaks wherever possible. However, the scale of salvage and other treatments should not generally result in degeneration of currently suitable owl habitat or other late-successional conditions.
>
> In some Late-Successional Reserves in these provinces, management that goes beyond these guidelines may be considered. Levels of risk in those Late-Successional Reserves are particularly high and may require additional measures. Consequently, management activities designed to reduce risk levels are encouraged in those Late-Successional Reserves even if a portion of the activities must take place in currently late-successional habitat. While risk-reduction efforts should generally be focused on young stands, activities in older stands may be appropriate if: (1) the proposed management activities will clearly result in greater assurance of long-term maintenance of habitat, (2) the activities are clearly needed to reduce risks, and (3) the activities will not prevent the Late-Successional Reserves from playing an effective role in the objectives for which they were established.
>
> Such activities in older stands may also be undertaken in Late-Successional Reserves in other provinces if levels of fire risk are particularly high.

Guidelines for Salvage

Salvage of dead trees is based on the following standards and guidelines, and is subject to review by the Regional Ecosystem Office. The Regional Ecosystem Office may develop criteria that would exempt some activities from review. Salvage of dead trees is not generally considered a silvicultural treatment within the context of these standards and guidelines.

Salvage is defined as the removal of trees from an area following a stand-replacing event such as those caused by wind, fires, insect infestations, volcanic eruptions, or diseases. Salvage guidelines are intended to prevent negative effects on late-successional habitat, while permitting some commercial wood volume removal. In some cases, salvage operations may actually facilitate habitat recovery. For example, excessive amounts of coarse woody debris may interfere with stand regeneration activities following some disturbances. In other cases, salvage may help reduce the risk of future stand-replacing disturbances. While priority should be given to salvage in areas

where it will have a positive effect on late-successional forest habitat, salvage operations should not diminish habitat suitability now or in the future.

Tree mortality is a natural process in a forest ecosystem. Diseased and damaged trees are key structural components of late-successional forests. Accordingly, management planning for Late-Successional Reserves must acknowledge the considerable value of retaining dead and dying trees in the forest as well as the benefits from salvage activities.

In all cases, planning for salvage should focus on long-range objectives, which are based on desired future condition of the forest. Because Late-Successional Reserves have been established to provide high quality habitat for species associated with late-successional forest conditions, management following a stand-replacing event should be designed to accelerate or not impede the development of those conditions. The rate of development of this habitat will vary among provinces and forest types and will be influenced by a complex interaction of stand-level factors that include site productivity, population dynamics of live trees and snags, and decay rates of coarse woody debris. Because there is much to learn about the development of species associated with these forests and their habitat, it seems prudent to only allow removal of conservative quantities of salvage material from Late-Successional Reserves and retain management opportunities until the process is better understood.

The following guidelines are general. Specific guidelines should be developed for each physiographic province, and possibly for different forest types within provinces.

1. The potential for benefit to species associated with late-successional forest conditions from salvage is greatest when stand-replacing events are involved. Salvage in disturbed sites of less than 10 acres is not appropriate because small forest openings are an important component of old-growth forests. In addition, salvage should occur only in stands where disturbance has reduced canopy closure to less than 40 percent, because stands with more closure are likely to provide some value for species associated with these forests.

2. Surviving trees will provide a significant residual of larger trees in the developing stand. In addition, defects caused by fire in residual trees may accelerate development of structural characteristics suitable for associated species. Also, those damaged trees that eventually die will provide additional snags. Consequently, all standing live trees should be retained, including those injured (e.g., scorched) but likely to survive. Inspection of the cambium layer can provide an indication of potential tree mortality.

3. Snags provide a variety of habitat benefits for a variety of wildlife species associated with late-successional forests. Accordingly, following stand-replacing disturbance, management should focus on retaining snags that are likely to persist until late-successional conditions have developed and the new stand is again producing large snags. Late-successional conditions are not associated with stands less than 80 years old.

4. Following a stand-replacing disturbance, management should retain adequate coarse woody debris quantities in the new stand so that in the future it will still contain amounts similar to naturally regenerated stands. The analysis that determines the amount of coarse woody debris to leave must account for the full period of time before the new stand begins to contribute coarse woody debris. As in the case of snags, province-level specifications must be provided for this guideline. Because coarse woody debris decay rates, forest dynamics, and site productivity undoubtedly will vary among provinces and forest types, the specifications also will vary.

   Province-level plans will establish appropriate levels of coarse woody debris and decay rates to be used. Levels will be "typical" and will not require retention of all material where it is highly concentrated, or too small to contribute to coarse woody debris over the long timeframes discussed. This standard and guideline represents one item to be considered and may indeed result in no salvage following windthrow in low density stands. As for other management activities, it is expected that salvage standards and guidelines will be refined through the implementation and adaptive management processes.

5. Some salvage that does not meet the preceding guidelines will be allowed when salvage is essential to reduce the future risk of fire or insect damage to late-successional forest conditions. This circumstance is most likely to occur in the eastern Oregon Cascades, eastern Washington Cascades, and California Cascades Provinces, and somewhat less likely to occur in the Oregon Klamath and California Klamath Provinces. It is important to understand that some risk associated with fire and insects is acceptable because they are natural forces influencing late-successional forest development. Consequently, salvage to reduce such risks should focus only on those areas where there is high risk of large-scale disturbance.

6. Removal of snags and logs may be necessary to reduce hazards to humans along roads and trails, and in or adjacent to campgrounds. Where materials must be removed from the site, as in a campground or on a road, a salvage sale is appropriate. In other areas, such as along roads, leaving material on site should be considered. Also, material will be left where available coarse woody debris is inadequate.

7. Where green trees, snags, and logs are present following disturbance, the green-tree and snag guidelines will be applied first, and completely satisfied where possible. The biomass left in snags can be credited toward the amount of coarse woody debris biomass needed to achieve management objectives.

8. These basic guidelines may not be applicable after disturbances in younger stands because remnant coarse woody debris may be relatively small. In these cases, diameter and biomass retention guidelines should be developed consistent with the intention of achieving late-successional forest conditions.

9. Logs present on the forest floor before a disturbance event provide habitat benefits that are likely to continue. It seldom will be appropriate to remove them. Where these logs are in an advanced state of decay, they will not be credited toward objectives for coarse woody debris retention developed after a disturbance event. Advanced state of decay should be defined as logs not expected to persist to the time when the new stand begins producing coarse woody debris.

10. The coarse woody debris retained should approximate the species composition of the original stand to help replicate preexisting suitable habitat conditions.

11. Some deviation from these general guidelines may be allowed to provide reasonable access to salvage sites and feasible logging operations. Such deviation should occur on as small a portion of the area as possible, and should not result in violation of the basic intent that late-successional forest habitat or the development of such habitat in the future should not be impaired throughout the area. While exceptions to the guidelines may be allowed to provide access and operability, some salvage opportunities will undoubtedly be foregone because of access, feasibility, and safety concerns.

Standards and Guidelines for Multiple-Use Activities Other Than Silviculture

The following standards and guidelines apply to Late-Successional Reserves and Managed Late-Successional Areas.

Introduction - As a general guideline, nonsilvicultural activities located inside Late- Successional Reserves that are neutral or beneficial to the creation and maintenance of latesuccessional habitat are allowed.

While most existing uses and development are envisioned to remain, it may be necessary to modify or eliminate some current activities in Late-Successional Reserves that pose adverse impacts. This may require the revision of management guidelines, procedures, or regulations governing these multiple-use activities. Adjustments in standards and guidelines must be reviewed by the Regional Ecosystem Office.

Road Construction and Maintenance - Road construction in Late-Successional Reserves for silvicultural, salvage, and other activities generally is not recommended unless potential benefits exceed the costs of habitat impairment.

If new roads are necessary to implement a practice that is otherwise in accordance with these guidelines, they will be kept to a minimum, be routed through non-late-successional habitat where possible, and be designed to minimize adverse impacts. Alternative access methods, such as aerial logging, should be considered to provide access for activities in reserves.

Road maintenance may include felling hazard trees along rights-of-way. Leaving material on site should be considered if available coarse woody debris is inadequate. Topping trees should be considered as an alternative to felling.

Fuelwood Gathering - Fuelwood gathering will be permitted only in existing cull decks, where green trees are marked by silviculturists to thin (consistent with standards and guidelines), to remove blowdown blocking roads, and in recently harvested timber sale units where down material will impede scheduled post-sale activities or pose an unacceptable risk of future large-scale disturbances. In all cases these activities should comply with the standards and guidelines for salvage and silvicultural activities.

American Indian Uses - The exercise of tribal treaty rights will not be restricted by these standards and guidelines unless the Regional Interagency Executive Committee determines that the restriction is (1) reasonable and necessary for preservation of the species at issue, (2) the conservation purpose of the restriction cannot be achieved solely by regulation of non-Indian activities, (3) the restriction is the least restrictive available to achieve the required conservation purpose, (4) the restriction does not discriminate against Indian activities either as stated or as applied, and (5) voluntary tribal conservation measures are not adequate to achieve the necessary conservation purpose.

Mining - The impacts of ongoing and proposed mining actions will be assessed, and mineral activity permits will include appropriate stipulations (e.g., seasonal or other restrictions) related to all phases of mineral activity. The guiding principle will be to design mitigation measures that minimize detrimental effects to late-successional habitat.

Developments - Development of new facilities that may adversely affect Late-Successional Reserves should not be permitted. New development proposals that address public needs or provide significant public benefits, such as powerlines, pipelines, reservoirs, recreation sites, or other public works projects will be reviewed on a case-by case basis and may be approved when adverse effects can be minimized and mitigated. These will be planned to have the least possible adverse impacts on Late-Successional Reserves. Developments will be located to avoid degradation of habitat and adverse effects on identified late-successional species. Existing developments in Late-Successional Reserves such as campgrounds, recreation residences, ski areas, utility corridors, and electronic sites are considered existing uses with respect to Late-Successional Reserve objectives, and may remain, consistent with other standards and guidelines. Routine maintenance of existing facilities is expected to have less effect on current old-growth conditions than development of new facilities. Maintenance activities may include felling hazard trees along utility rights-of-way, trails, and other developed areas.

Land Exchanges - Land exchanges involving Late-Successional Reserves will be considered if they provide benefits equal to or better than current conditions. Consider land exchanges especially to improve area, distribution, and quality (e.g., connectivity, shape, contribution to biodiversity) of Late-Successional Reserves, especially where public and private lands are intermingled (e.g., checkerboard ownership).

Habitat Improvement Projects - Projects designed to improve conditions for fish, wildlife, or watersheds should be considered if they provide late-successional habitat benefits or if their effect on late-successional associated species is negligible. Projects required for recovery of threatened or endangered species should be considered even if they result in some reduction of habitat quality for other late-successional species. For example, watershed rehabilitation projects, such as felling trees along streams, will be coordinated with a wildlife biologist and may include seasonal restrictions. Design and implement watershed restoration projects in a manner that is consistent with Late-Successional Reserve objectives.

Range Management - Range-related management that does not adversely affect latesuccessional habitat will be developed in coordination with wildlife and fisheries biologists. Adjust or eliminate grazing practices that retard or prevent attainment of reserve objectives. Evaluate effects of existing and proposed livestock management and handling facilities in reserves to determine if reserve objectives are met. Where objectives cannot be met, relocate livestock management and/or handling facilities.

Fire Suppression and Prevention - Each Late-Successional Reserve will be included in fire management planning as part of watershed analysis. Fuels management in Late-Successional Reserves will utilize minimum impact suppression methods in accordance with guidelines for reducing risks of large-scale disturbances. Plans for wildfire suppression will emphasize maintaining late-successional habitat. During actual fire suppression activities, fire managers will consult with resource specialists (e.g., botanists, fisheries and wildlife biologists, hydrologists) familiar with the area, these standards and guidelines, and their objectives, to assure that habitat damage is minimized. Until a fire management plan is completed for Late-Successional Reserves, suppress wildfire to avoid loss of habitat in order to maintain future management options.

In Late-Successional Reserves, a specific fire management plan will be prepared prior to any habitat manipulation activities. This plan, prepared during watershed analysis or as an element of province-level planning or a Late-Successional Reserve assessment, should specify how hazard reduction and other prescribed fire applications will meet the objectives of the Late-Successional Reserve. Until the plan is approved, proposed activities will be subject to review by the Regional Ecosystem Office. The Regional Ecosystem Office may develop additional guidelines that would exempt some activities from review. In all Late-Successional Reserves, watershed analysis will provide information to determine the amount of coarse woody debris to be retained when applying prescribed fire.

In Riparian and Late-Successional Reserves, the goal of wildfire suppression is to limit the size of all fires. When watershed analysis, province-level planning, or a Late-Successional Reserve assessment are completed, some natural fires may be allowed to burn under prescribed conditions. Rapidly extinguishing smoldering coarse woody debris and duff should be considered to preserve these ecosystem elements.

Special Forest Products - Special forest products include but are not limited to posts, poles, rails, landscape transplants, yew bark, shakes, seed cones, Christmas trees, boughs, mushrooms, fruits, berries, hardwoods, forest greens (e.g., ferns, huckleberry, salal, beargrass, Oregon grape, and mosses), and medicinal forest products. In all cases, evaluate whether activities have adverse effects on Late-Successional Reserve objectives. Sales will ensure resource sustainability and protection of other resource values such as special status plant or animal species. Where these activities are extensive (e.g., collection of Pacific Yew bark or fungi), it will be appropriate to evaluate whether they have significant effects on latesuccessional habitat. Restrictions may be appropriate in some cases.

Recreational Uses - Dispersed recreational uses, including hunting and fishing, generally are consistent with the objectives of Late-Successional Reserves. Use adjustment measures such as education, use limitations, traffic control devices, or increased maintenance when dispersed and developed recreation practices retard or prevent attainment of Late-Successional Reserve objectives.

Research - A variety of wildlife and other research activities may be ongoing and proposed in late-successional habitat. These activities must be assessed to determine if they are consistent with Late-Successional Reserve objectives. Some activities (including those within experimental forests) not otherwise consistent with the objectives may be appropriate, particularly if the activities will test critical assumptions of these standards and guidelines, will produce results important for habitat development, or if the activities represent continuation of long-term research. These activities should only be considered if there are no equivalent opportunities outside Late-Successional Reserves.

Current, funded, agency-approved research that meets the above criteria is assumed to continue if analysis ensures that a significant risk to Aquatic Conservation Strategy objectives does not exist. Research Stations and other Forest Service and BLM units will, within 180 days of the signing of the Record of Decision for these standards and guidelines, submit a brief project summary to the Regional Ecosystem Office of ongoing research projects that are potentially inconsistent with other standards and guidelines of this document, but are expected to continue under the above research exception. The Regional Ecosystem Office may choose to more formally review specific projects, and may recommend to the Regional Interagency Executive Committee modification, up to and including cancellation, of those projects having an unacceptable risk to Late-Successional Reserve objectives.

Rights-of-Way, Contracted Rights, Easements, and Special Use Permits - Access to nonfederal lands through Late-Successional Reserves will be considered and existing right-of-way agreements, contracted rights, easements, and special use permits in Late-Successional Reserves will be recognized as valid uses. New access proposals may require mitigation measures to reduce adverse effects on Late-Successional Reserves. In these cases, alternate routes that avoid late-successional habitat should be considered. If roads must be routed through a reserve, they will be designed and located to have the least impact on late-successional habitat. Review all special use permits and when objectives of Late-Successional Reserves are not being met, reduce impacts through either modification of existing permits or education.

Nonnative Species - In general nonnative species (plant and animal) should not be introduced into Late-Successional Reserves. If an introduction of nonnative species is proposed, complete an assessment of impacts and avoid any introduction that would retard or prevent achievement of Late-Successional Reserve objectives. Evaluate impacts of nonnative species (plant and animal) currently existing within reserves, and develop plans and recommendations for eliminating or controlling nonnative species that are inconsistent with Late-Successional Reserve objectives. These will include an analysis of the effects of implementing such programs to other species or habitats within Late-Successional Reserves.

Other - Other activities should be evaluated by local interdisciplinary teams and appropriate guidelines should be written and documented. Activities deemed to have potentially adverse effects on Late-Successional Reserve objectives are subject to review of the Regional Ecosystem Office. The Regional Ecosystem Office may develop additional criteria for exempting some additional activities from review.

Protection Buffers

Protection Buffers are additional standards and guidelines from the Scientific Analysis Team Report for specific rare and locally endemic species, and other specific species in the upland forest matrix. The following rare and locally endemic species are likely to be assured viability if they occur within reserves. However, there might be occupied locations outside these areas that will be important to protect as well. Protocols for surveys will be developed that will ensure a high likelihood of locating these occupied sites, and such surveys will be conducted prior to ground-disturbing activities within the known or suspected ranges and within the habitat types or vegetation communities occupied by these species, according to the implementation schedule for Survey and Manage components 1 and 2 on pages C-4 and C-5 of these standards and guidelines. When located, the occupied sites need to be protected as follows.

Nonvascular Plants:

Ptilidium californicum (Liverwort) - This species is rare and has a very limited distribution in old white fir forests with fallen trees. It occurs on trunks of trees at about 5000-feet elevation. Mitigation options include finding locations and maintaining stands of overmature white fir at about 5000-feet elevation for inoculum and dispersal along corridors; and studying specific distribution patterns. Protect known occupied locations if distribution patterns are disjunct and highly localized by deferring timber harvest and avoiding removal of fallen trees and logs.

Ulota meglospora (Moss) - This species occurs in northern California and southwest Oregon. It is best developed (locally abundant) in very old stands of tanoak, Douglas-fir, and other conifer species further north, but is generally scarce throughout its range. The species is poorly known ecologically. Mitigation activities include conducting basic ecological studies, and surveying for presence, particularly in Oregon. Protect known occupied sites if distribution patterns are disjunct and highly localized. Defer timber harvest or other activities which would not maintain desired habitat characteristics and population levels.

Aleuria rhenana (Fungus) - This mushroom is widely distributed but rare and little known throughout its range, known from one collection from Mt. Rainier National Park. It is a conifer litter decomposer. Mitigation activities include conducting ecological studies and surveys to determine localities. Protect known populations if surveys continue to indicate that the population is rare. Defer ground-disturbing activities.

Otidea leporina, O. onotica, and *O. smithii* (Fungi) - These mushrooms occur in conifer duff, and are widespread in distribution but uncommon. They are dependent on older-age forests. Specific mitigation options include protecting older forests from ground disturbance where the species are located.

For the plants listed above, it is recommended that Regional or state office-level ecologists or botanists should: (1) maintain a spatially explicit data base of all known sites in National Forests and BLM Districts, and (2) develop species or area management plans, to be implemented under the guidance of the regional botany programs.

Amphibians:

Shasta Salamander - This species is very narrowly distributed, occurring only in localized populations on the Shasta-Trinity National Forest. Only a small part of its range is included within Habitat Conservation Areas identified by the Interagency Scientific Committee (1990) (status within Late-Successional Reserves has not been determined). It occurs in association with limestone outcrops, protected by an overstory canopy. All known and future localities must be delineated and protected from timber harvest, mining, quarry activity, and road building within the delineated site, and a buffer of at least the height of one site-potential tree or 100 feet horizontal distance, whichever is greater, should surround the outcrop. Additional surveys conducted using a standardized protocol must be undertaken to identify and delineate all occupied sites within the species' potential range.

Birds:

Great Gray Owl - Within the range of the northern spotted owl, the great gray owl is most common in lodgepole pine forests adjacent to meadows. However, it is also found in other coniferous forest types. In some locations, such as on the Willamette National Forest west of the crest of the Cascade Range, at least some shelterwood harvesting seems to be beneficial for the species by opening up otherwise closed canopy cover for foraging. In doing so, consequences to species such as northern goshawk and American marten must be evaluated. Specific mitigation measures for the great gray owl, within the range of the northern spotted owl, include the following: provide a no-harvest buffer of 300 feet around meadows and natural openings and establish 1/4-mile protection zones around known nest sites. Within one year of the signing of the Record of Decision for these standards and guidelines, develop and implement a standardized protocol for surveys; survey for nest locations using the protocol. Protect all future discovered nest sites as previously described.

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Memorandum

Date: May 12, 2003
To: Regional Interagency Executive Committee (See Attached Distribution List)
From: Anne Badgley, Executive Director /s/Anne Badgley
Subject: Assessment and Review of Proposed Research under the Northwest Forest Plan

Purpose: The purpose of this memorandum is to clarify implementation of certain Northwest Forest Plan (NWFP) provisions regarding research assessments and reviews.

Background: In 2001, the Regional Ecosystem Office (REO) received questions from field offices asking whether REO review of new proposed research is required. The REO prepared findings to clarify two aspects of the research questions:

1. Reviews. When is REO review of research required?
2. Assessments. Who assesses new research proposals and what factors should be considered?

This memorandum is based on interagency discussions (which included participation by research agency representatives) and review of NWFP provisions. Key NWFP provisions are attached and referenced below.

Findings: Reviews. The NWFP Standards and Guidelines (S&Gs) distinguish between ongoing and proposed research (S&Gs, pp. C-4, 18, 19 & 38). Project summaries of ongoing research, i.e., current, funded, agency approved research, were to be submitted to REO for review within 180 days after the date the NWFP Record of Decision (ROD) was signed (April 13, 1994). New research, i.e., research proposed after the NWFP was signed, does not require REO, Research and Monitoring Group (RMG), or Regional Interagency Executive Committee (RIEC) review. However, agencies may request REO or RMG assistance in conducting science reviews of new proposed research, particularly where independent, regional-scale, or interagency analysis is indicated. Requests should be submitted through the agency's RIEC executive to the REO Executive Director.

Assessments. The S&Gs (pp. C-4, 18 & 38) require that research be assessed to determine if it is consistent with the objectives of the standards and guidelines. The appropriate land manager is responsible for assessing proposed research and has discretion regarding how to conduct the assessment and documentation process. For example, the assessment and documentation may be completed in conjunction with the NEPA process.

The ROD states that, where appropriate, some research activities may be exempted from the standards and guidelines (ROD, p.15). The S&Gs further provide for this by indicating that some activities not otherwise consistent with the objectives of the standards and guidelines may be appropriate (S&Gs, pp. C-4, 18 & 38), particularly if the activities:

- Will test critical assumptions of these standards and guidelines;
- Will produce results important for habitat development; or
- If the activities represent continuation of long-term research.

In addition, the S&Gs (p. C-4) state that every effort should be made to locate non-conforming activities in land allocations where they will have the least effect upon the objectives of the standards and guidelines. (Language specific to Late-Successsional Reserves (LSRs) and Riparian Reserves (RRs) is provided in the S&Gs (pp. C-18 & 38)). This factor should be considered and documented during the assessment.

The land manager is responsible for identifying any proposed research activities that are inconsistent with the objectives of the standards and guidelines, for assessing whether the activities are appropriate, and for ensuring that appropriate efforts have been made to locate non-conforming activities in land allocations where they will have the least effect upon the objectives of the standards and guidelines. The land manager may then exempt research activities from the standards and guidelines where appropriate. All research activities must meet the requirements of applicable federal laws (ROD, p.15), including the Endangered Species Act, NEPA, etc.

Related Considerations: The REO identified other factors that may be helpful to ensure scientific credibility of proposed research (a basic principle of the NWFP). These factors are not specified in the NWFP, however, land managers may consider them if appropriate during design and assessment of new research proposals, particularly proposals which include activities inconsistent with the objectives of the standards and guidelines. Optional factors that may be appropriate to consider include:

1. The extent to which the proposed research represents credible science. The following questions may be helpful in evaluating whether the proposed research represents credible science:
   - What hypotheses will be tested by the proposed research, and how are they linked to assumptions or uncertainties in the S&Gs?
   - Is the proposed study design adequate to test the stated hypotheses?
   - What are the temporal and spatial zones of inference for the proposed research?
   - Has the proposal been the subject of an independent science review? If so, what are the results?
2. The potential of the research to contribute to scientific knowledge of importance beyond the local area.
3. The potential to modify the research proposal to make it more consistent with the objectives of the standards and guidelines.
4. The extent to which the desired results could be obtained if the research was modified to conform to the standards and guidelines.

This memorandum is intended for use as the basis for responding to future inquiries regarding research assessments and reviews. All RIEC executives are encouraged to distribute this memorandum to appropriate individuals in their agency. If you have comments or need additional information, please contact me at 503-808-2165, or your REO representative.

cc: REO/RMG reps
Ken Denton (FS)
John Cissel (BLM)

1819final.doc/kc

Attachment: NWFP Excerpts Related to Research Assessments and Reviews (2 pp.)

Distribution List for RIEC
Dave Allen, US Fish & Wildlife Service
Dave Wesley, US Fish & Wildlife Service (Alt)
Elaine M. Brong, Bureau of Land Management
Judy Nelson, Bureau of Land Management (Alt)
Jon Jarvis, National Park Service
Jim Shevock, National Park Service (Alt)
Linda Goodman, Forest Service
Lisa Freedman, Forest Service (Alt)
Bob Graham, Natural Resources Conservation Service
Dianne Guidry, Natural Resources Conservation Service (Alt)
Col. Richard W. Hobernicht, U.S. Army Corps of Engineers
Curt Loop, U.S. Army Corps of Engineers (Alt)
Anne Kinsinger, USGS Western Region
Dave Busch, USGS/REO (Alt)
Robert Lohn, National Marine Fisheries Service
Mike Crouse, National Marine Fisheries Service (Alt)
Jennifer Orme-Zavaleta, Western Ecology Division, EPA
Dan McKenzie, Western Ecology Division, EPA (Alt)
Dave Powers, Environmental Protection Agency
Dan Opalski, Environmental Protection Agency (Alt)
Stan M. Speaks, Bureau of Indian Affairs
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Tom Quigley, Pacific Northwest Station, Forest Service
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Kathy Anderson, Forest Service (Alt)
Steve Thompson, U.S. Fish and Wildlife Service
John Engbring, U.S. Fish and Wildlife Service (Alt)
Phil Detrich, U.S. Fish and Wildlife Service (Alt)
Michael Pool, Bureau of Land Management
Paul Roush, Bureau of Land Management (Alt)

NWFP Excerpts Related to Research Assessments and Reviews

This enclosure provides excerpts from the Northwest Forest Plan Record of Decision (ROD) and Standards and Guidelines (S&Gs) which are referenced in the accompanying memorandum on research assessments and reviews.

ROD, p. 15:
"An important component of this decision is the facilitation of research activities to gather information and test hypotheses in a range of environmental conditions. Although research activities are among the primary purposes of adaptive management areas and experimental forests, this decision does not intend to limit research activities to these land allocations. Where appropriate, some research activities may be exempted from the standards and guidelines of this decision. However, every effort should be made to locate non-conforming activities in land allocations where they will have the least adverse effect upon the objectives of the applicable standards and guidelines. All research activities must meet the requirements of applicable federal laws, including the Endangered Species Act."

S&Gs, p. C-4:
"A variety of wildlife and other research activities may be ongoing and proposed in all land allocations. These activities must be assessed to determine if they are consistent with the objectives of these standards and guidelines. Some activities (including those within experimental forests) not otherwise consistent with the objectives may be appropriate, particularly if the activities will test critical assumptions of these standards and guidelines, will produce results important for habitat development, or if the activities represent continuation of long-term research. Every effort should be made to locate non-conforming activities in land allocations where they will have the least adverse effect upon the objectives of these standards and guidelines.

Current, funded, agency-approved research that meets the above criteria, is assumed to continue if analysis ensures that a significant risk to Aquatic Conservation Strategy objectives does not exist. Research Stations and other Forest Service and BLM units will, within 180 days of the signing of the Record of Decision, submit a brief project summary to the Regional Ecosystem Office of ongoing research projects that are potentially inconsistent with other standards and guidelines in this document but are expected to continue under the above research exception. The Regional Ecosystem Office may choose to more formally review specific projects, and may recommend to the Regional Interagency Executive Committee modification, up to and including cancellation, of those projects that have an unacceptable risk [to] the objectives of these standards and guidelines."

S&Gs, pp. C-18,19:
"A variety of wildlife and other research activities may be ongoing and proposed in late-successional habitat. These activities must be assessed to determine if they are consistent with Late-Successional Reserve objectives. Some activities (including those within experimental forests) not otherwise consistent with the objectives may be appropriate, particularly if the activities will test critical assumptions of these standards and guidelines, will produce results important for habitat development, or if the activities represent continuation of long-term research. These activities should only be considered if there are no equivalent opportunities outside Late-Successional Reserves.

Current, funded, agency-approved research that meets the above criteria is assumed to continue if analysis ensures that a significant risk to Aquatic Conservation Strategy objectives does not exist. Research Stations and other Forest Service and BLM units will, within 180 days of the signing of the Record of Decision for these standards and guidelines, submit a brief project summary to the Regional Ecosystem Office of ongoing research projects that are potentially inconsistent with other standards and guidelines of this document, but are expected to continue under the above research exception. The Regional Ecosystem Office may choose to more formally review specific projects, and may recommend to the Regional Interagency Executive Committee modification, up to and including cancellation, of those projects having an unacceptable risk to Late-Successional Reserve objectives."

S&Gs, p. C-38:
"RS-1. A variety of research activities may be ongoing and proposed in Key Watersheds and Riparian Reserves. These activities must be analyzed to ensure that significant risk to the watershed values does not exist. If significant risk is present and cannot be mitigated, study sites must be relocated. Some activities not otherwise consistent with the objectives may be appropriate, particularly if the activities will test critical assumptions of these standards and guidelines; will produce results important for establishing or accelerating vegetation and structural characteristics for maintaining or restoring aquatic and riparian ecosystems; or the activities represent continuation of long-term research. These activities should be considered only if there are no equivalent opportunities outside of Key Watersheds and Riparian Reserves.

RS-2. Current, funded, agency-approved research, which meets the above criteria, is assumed to continue if analysis ensures that a significant risk to Aquatic Conservation Strategy objectives does not exist. Research Stations and other Forest Service and BLM units will, within 180 days of the signing of the Record of Decision adopting these standards and guidelines, submit a brief project summary to the Regional Ecosystem Office of ongoing research projects that are potentially inconsistent with other standards and guidelines but are expected to continue under the above research exception. The Regional Ecosystem Office may choose to more formally review specific projects, and may recommend to the Regional Interagency Executive Committee modification, up to and including cancellation, of those projects having an unacceptable risk to Key Watersheds and Riparian Reserves. Risk will be considered within the context of the Aquatic Conservation Strategy objectives."

S&Gs, pp. D-7, 8:
"Monitoring and research, with careful experimental design, will be conducted in Adaptive Management Areas. Research in forest ecology and management as well as social, biological, and earth sciences may be conducted. Each Adaptive Management Area will have an interdisciplinary technical advisory panel that will provide advice to managers and the local communities involved with this effort. The technical advisory panels will provide advice and information on the appropriateness of the project.

Direction and review are provided by the Regional Interagency Executive Committee, through the Regional Ecosystem Office. This review will help assure that plans and projects developed for the various Adaptive Management Areas will be both scientifically and ecologically credible. It will assure that new, innovative approaches are used, that the laws and the goals of the plan are met, and that validation monitoring is incorporated."

S&Gs pp. E-17, 18:
"The Research and Monitoring Committee will review and evaluate ongoing research; develop a research plan to address critical natural resource issues; address biological, social, economic, and adaptive management research topics; and develop and review scientifically credible, cost efficient monitoring plans; and facilitate scientific review of proposed changes to the standards and guidelines."

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Memorandum

Date: May 13, 2003

To: Elaine M. Brong, OR/WA State Director, Bureau of Land Management

From: Anne Badgley, Executive Director */s/Anne Badgley*

Subject: Timbered Rock Fire Salvage and Elk Creek Late-Successional Reserve Restoration – Butte Resource Area Clarification

This memorandum is in response to your request dated May 1, 2003 regarding clarification of interpretation of key concepts for the Timbered Rock Fire Salvage and Elk Creek Late-Successional Reserve Restoration – Butte Resource Area. The Late-Successional Reserves (LSR) interagency work group reviewed proposals for the Timbered Rock Environmental Impact Statement on May 1, 2003. The workgroup has provided several recommendations and findings as outlined below and requested additional review of the final proposed action (see item 3).

Your memo asked questions about four issues:

1. The 10 acre salvage stand-replacing standard and guideline (C-14) and Regional Ecosystem Office/ LSR Work Group exemption criteria – stand or project area basis

   The District requested clarification on scale of application of this Standard and Guideline (S&G) from the LSR Work Group. The Work Group concluded that the S&G listed on page C-14, number 1, is the standard that defines the appropriate threshold for salvage activities.

   "The potential for benefit to species associated with late-successional forest conditions from salvage is greatest when stand-replacing events are involved. Salvage in disturbed sites of less than 10 acres is not appropriate because small forest openings are an important component of old-growth forests."

   The Work Group concluded that proposals to salvage stands less than ten (10) acres in size within the burn perimeter would generally not be consistent with objectives for managing LSRs. Departures from this S&G would require a plan amendment.

   Treatments to reduce risk, however, can be designed to meet site-specific objectives for risk management. The Record of Decision (C-15) recognized that there may be instances where departure from salvage S&Gs may be necessary to reduce future risk of fire or insect damage to late-successional conditions. In these situations, the ROD states *"salvage to reduce such risks should focus only on those areas where there is a high risk of large-scale disturbance.*"

2. Use of snag and coarse woody debris levels from South Cascades Late-Successional Reserve Assessment (LSRA) and potential modification for dry vegetation within areas with frequent wildfire histories and moderate to high risks

   The Work Group concluded that if proposed amounts of standing dead and down wood proposed for retention in salvage units were estimated from the DECAID tool, then the proposed action would be

consistent with objectives for managing LSRs. Alternatively, the District could submit for review, an LSRA amendment with standing dead and down wood amounts derived from local data.

3. Research deviation from standards and guidelines

   The REO Research Monitoring Group (RMG) reviewed Attachment 2 ("Research Review Clarification") to your memorandum of May 1, 2003. That attachment stated:
   "… pending completion of the REO memo, we request written concurrence that under the NWFP: 1) authority to conduct the research assessment and exempt research as appropriate [r]ests with the appropriate agency official; 2) no REO/RMG/RMC review of proposed or new research activities is required under the NWFP; and 3) the agency official has discretion regarding how to conduct the assessment and documentation process."

   Since the REO memorandum clarifying NWFP provisions related to review and assessment of new research proposals was finalized on May 12, 2003, no advance concurrence is needed. Instead, the final memorandum is attached for your information. It includes findings that are consistent with your three statements (above), as well as other information that may be helpful during the assessment process.

4. South Cascade LSRA estimated maximum treatments and need for additional project review of proposed treatment levels

   As per our letter dated February 10, 1998, your LSRA provides sufficient framework and context for decisions involving future projects and activities. The letter also noted that project plans would be fine-tuned through Watershed Analysis, NEPA, and other site-specific treatment determinations. Once the final proposed action for the Timbered Rock EIS has been submitted, the LSR work group will complete its review based upon the silvicultural, risk, and salvage activities described in Chapter 4 of the LSRA.

   It appears that you and your staff have done a thorough job evaluating the potential impacts related to the proposed salvage and restoration activities. If you have any questions regarding the above conclusions, how to access the DECAID tool, or other related questions, please do not hesitate to contact Shawne Mohoric (503-808-2175).

Attachment:
Assessment and Review of Proposed Research under the Northwest Forest Plan

cc:
Mary Smelcer, Acting District Manager, BLM Medford District Officer
Larry Larson, BLM OR-931
Debbie Pietrzak, BLM, Regional Ecosystem Office Representative
Shawne Mohoric, LSR Work Group Chair

1827/ShM

Appendix B
South Cascades Late-Successional Reserve Assessment
Chapters 3, 4, and 5

CHAPTER 3: EXISTING CONDITIONS

CONTEXT OF THE SOUTH CASCADES LSR NETWORK

INTRODUCTION

The South Cascade LSRs are part of a regional network designed in association with other land allocations (riparian reserves, National Parks, Wildernesses, botanical areas, etc.) to provide functional late seral habitat, including long-term dispersal and migratory pathways.

In a regional perspective, the south Cascades provide a link and are a north-south transition area between the Sierra Nevada Mountains of northern California and the northern Cascade Mountains of Oregon and Washington. The Siskiyou Mountains run generally east-west, and provide connectivity between the coastal and inland south Cascade mountain areas. The Columbia and Klamath Rivers, the only major rivers which significantly breach the Cascade and Coast ranges, allow mixing of inland and coastal species and genetic varieties. These links allow movement of species and genetic material north and south and east and west in response to changes in climate such as occurred during the ice ages and the xerothermic period. These links are still important in the evolutionary process and health of the Pacific Northwest flora and fauna.

The habitat within the South Cascades LSRs serves as source areas for spotted owls and other late-successional and old growth dependent species. LSR 222 is the largest contiguous Reserve within the range of the northern spotted owl. Since species depend on habitat, a variety of habitats present over time and space provides for a broad range of species, including rare and sensitive species and those associated with late seral stages. Successional and disturbance processes have provided a varied seral stage mix and a functional landscape pattern. However, the effects of fire, the most influential process, have been altered and will likely continue to be modified well into the future.

Management will focus on the amount and distribution of late seral habitat, number and size of trees, both live and dead, down woody material on the forest floor and in streams, and canopy density, continuity, and layering. Over decades, the needs of indicator species will be determined. In the meantime, elements of older forests will be maintained and created.

PHYSIOGRAPHIC PROVINCES

The Umpqua, Rogue River, and that portion of the Willamette National Forest within LSR 222, along with the Roseburg and Medford Districts of the BLM, are climatically different from the Willamette National Forest north of LSR 222, the Eugene District of the BLM, and forests farther north in the Western Cascade Oregon Province.

This climatic difference may be explained by geography. In southwestern Oregon, the Siskiyou Mountains occur adjacent to the coast, with peaks up to 7000 feet. These peaks effectively block marine influences and allow high growing season temperatures, frequent frosts, high evaporative demand, and lower precipitation. The impacts are especially felt on the Rogue River NF and the southern districts of the Umpqua NF. The coastal mountain peaks north of

Port Orford and west of Cottage Grove are barely 4000 feet in elevation and allow the inflow of moderating, moist marine air. For example, in 1982, the temperatures for June, July, and August, averaged 2 degrees higher in Prospect, compared to Dorena, and the number of days between the last spring frost and the first fall frost was 106 and 160, respectively. The average annual precipitation in Dorena was 51 inches, compared with 44 inches in Prospect. The climate in southwest Oregon is Mediterranean. This break in climate occurs along the Calapooya Divide. Essentially all of the Rogue River and Siskiyou National Forests, the Medford District of the BLM, and all of the Umpqua National Forest except for the Cottage Grove Ranger District, reflect this climate. This is characteristic of the Klamath Province. The portion of the LSR 222 to the east of the Calapooya Divide (in the Willamette National Forest) appears to be in a rain shadow, and also exhibits the vegetation characteristics of a drier climate.

These climatic differences are reflected in limited tree growth, reduced canopy cover in mature forests (average of 55 percent in southwest Oregon vs. 70 percent in western Oregon), and fire regime differences that have been documented with fire history studies. Southwest Oregon fires occur with higher frequency and lower intensity compared with fire regimes in western Oregon. Levels of down wood appear to be less in southwest Oregon, suggesting higher rates of decomposition compared with areas to the north and greater consumption by fire.

Ecological processes on the Rogue River NF, Medford and Roseburg Districts of the BLM, and the North Umpqua, Diamond Lake, and Tiller Ranger Districts of the Umpqua NF, are more closely aligned with those of the Siskiyou NF, and these areas fall more appropriately into the Klamath Province and allied Mediterranean ecosystems.

The existing condition section on insects and diseases also suggests that incidence and severity in the South Cascades LSRs represents more closely the conditions found in the Eastern Oregon Cascades and Oregon and California Klamath Provinces.

PAST LAND USES

Vegetative structure, function, and pattern in the South Cascades LSRs have been influenced by humans. The most important of these human influences are fire management, including both the deliberate setting of fires by Indians and post-1900s fire suppression activities, and timber harvest.

Several major Indian groups were present in the larger geographic area where the South Cascades LSRs occur: they include the Upper Umpqua, Upland Takelma, Klamath, the southern Molala, and possibly the Shasta peoples. Major economies of these groups were based on hunting and gathering in the meadows, forests, and marshlands, and the fisheries of the Klamath Basin, Umpqua, and Rogue Rivers. Anadromous fish supplemented their diets. Trout were fished from the lakes and streams. A variety of large and small game were hunted. Plant food sources included acorns, camas bulbs, serviceberry, blackberry, and sugar pine seeds, and the inner bark of ponderosa pine. One of the most important plant food sources were the extensive huckleberry patches along the Rogue-Umpqua divide and in the high Cascades. The huckleberry fields were perpetuated by the almost yearly setting of ground fires. While other uses of fire by Indians are less well documented than in other areas, it is believed that these peoples used fire to maintain travel corridors and maintain open understories to enhance hunting and gathering activities.

Early Euro-American residents of the Rogue and Umpqua Valleys viewed the forests of the South Cascades as barriers to settlement and concentrated their efforts on developing transportation routes through them. Hudson Bay Company trappers used trails built and maintained by Indians. Military roads linking the east and west sides of Oregon were built and improved. Discovery of gold in the John Day River country of northeastern Oregon led to the building of a road through the northern portion of the area in 1864. After eventually falling to disuse, this route would become the Diamond Lake Road in the early twentieth century.

The building of travel routes opened the area to grazing, lumbering, and settlement. Large herds of sheep used the area, especially in the time prior to and at the turn of the century. One of the major duties of those hired to work on the Crater National Forest, created in 1907, was the administration of grazing regulations. Cattle were also grazed on forested lands, especially at lower elevations. Large sugar pines provided lumber for the booming mining area near Jacksonville, Oregon. The thriving fruit orchard industry in the Rogue Valley increased the area population, increasing the demand for drinking and irrigation water, and for wood products. Several irrigation pipelines were constructed from Cascades lakes and springs to the valley floor. Many small lumber mills were in operation and railroads were built into the southern portion of the area to move logs and lumber to the mills and population centers.

Extensive areas of timber harvest occurred as early as the 1920s within the LSR network. Access to railheads slowed harvest rates until the 1950s but as the demand for wood products increased, roadbuilding increased, and many areas were entered for harvest. Clearcut harvest created small patches of early seral conditions throughout much of the LSRs. Currently, early seral conditions in the LSRs range from 19 to 36 percent. Selective cutting of individual trees continued to occur on many sites; species composition shifted as a result of partial harvest, extensive road networks were built, and ground disturbance was often intense on some sites.

Large forest fires in the early 1900s led to increased emphasis by government agencies on fire suppression. By the 1940s, with access to the forest increased, and fire fighting techniques improved, fire suppression was highly effective. Excluding fire from stands within the LSRs has resulted in altered stand composition and structure.

Road improvements also opened the area for recreation. People visited, camped at, and developed the mineral springs found in the southern portion of the area. Farther north, huckleberry picking became an important pastime for residents of the Rogue and Umpqua Valleys; hundreds of people would camp during the late summer at “resorts” established in the area between 1910 and the 1930s. Campgrounds were established and facilities were built to cater to the recreationists who used the area directly or who passed through on their way to Crater Lake National Park.

The introduction of an exotic fungus also influenced human activities in the area. White pine blister rust was established in western white pine and sugar pine stands in the South Cascades LSRs by the early 1920s. Union Creek became the center for a massive effort at eradicating Ribes, the gooseberry or currant bushes that are the alternate host for the introduced fungus white pine blister rust. Hundreds of men were employed during the 1930s and 1940s to grub out the bushes on the steep, brushy slopes of the Cascades in this area.

PRESENT LAND USES

Table 6 presents a summary of present land uses within each LSR. It is organized by LSR, administrative unit, and the ROD section, “Multiple Use Activities Other Than Silviculture” (ROD C-16). It can be used as an overview, and to compare how individual units are currently treating these topics.

The information was collected with visits to specialists on individual units, during the period from December 1996 through January 1997. Resource specialists were asked about present land uses, and whether there were any known inconsistencies with LSR objectives. None of the current uses were judged by these specialists to have adverse effects on LSR objectives. However, current land uses, particularly firewood harvest and mushroom permits, should continue to be examined for consistency with standards and guidelines and LSR objectives.

Some management activities in LSRs or riparian reserves may seem to conflict with objectives if they are analyzed only at the site scale, or in the short term. Analysis of management actions should include both the short term and long term temporal scale, and the site and landscape spatial scales in order to assess consistency with LSR or riparian reserve objectives. See also the section, “Treatments and Criteria for Multiple Use Activities Other than Silviculture”, later in this document.

Current land use	LSR 224 Medford BLM	LSR 225 Rogue River NF	LSR 226 Rogue River NF	LSR 227 Winema/ Rogue River NF
Road Construction & Maintenance	Improvements are planned by Fed. Highway Admin. On Elk Cr. Road. Does impact LSR riparian.	Wild & Scenic River plans include road closure recommendations. Some roads closed to ORV use for resource objectives. Motorcycle ORV trail not in conflict with LSR.	Access and Travel Mgm't planning on-going.	No Access and Travel Mgm't plans in place. Road closure recommendations are in watershe analyses.
Fuelwood gathering	No new permits being issued.	Personal use only.[7]	Yes.[7]	None except by campers.[7]
American Indian Uses	None known.	Huckleberry agreement exists along Rogue-Umpqua Divide. Indian concern about Quartz Mt. Mining.	NA.	Vision quest sites. No huckleberry fields.
Mining	None, except incidental expansion of rock pits less than 2 acres.	Foster Cr. Surplus Mine includes 2 small sites and 5 ac. Open pit. Not in conflict with LSR objectives. Current rock pit use.	None, but some rock pits.	Several gravel pits.
Developments	See below.	Rental lookout. See Rec. uses. Also a dumpsite.	2 Guard stations, lookout, Campgrounds.	Pelican Butte proposed ski area; Developed campgrounds at Lake Woods and Fourmile. Rec. residences. 3 organization camps, resort at Lake of the Woods. Gre Meadow dam, Cascade Canal.
Land Exchanges	None.	None.	None.	None.
Habitat Improvement Projects	Thinning around Sugar Pine. Pond improvements for Turtles.	Underburning pine to reduce needle mat for better forage for owl and big game.	None planned.	Some water developments, density management, underburning for bal eagles. Thinning for big pine healt

[7] Needs to be examined for consistency. There are standards and guidelines that specify where fuelwood gathering is appropriate, ROD, C-16.

Current land use	LSR 224 Medford BLM	LSR 225 Rogue River NF	LSR 226 Rogue River NF	LSR 227 Winema/ Rogue River NF
Range Management	Entire LSR is transitory range (6 allotments), proposing fencing along riparian areas, in cooperation with private timber co.	Crater, Alkalai, and Hammocker grazing allotments--reducing cows in north part; increasing 10 percent in south.	2-3 Allotments, most of LSR has grazing.	Allotment south of Lake-of-the-Woods covers about 10 percent of the area.
Fire Suppression, Prevention (Recent Significant Fires)	Burt Peak fire, 3000 ac., 1987.	No recent fires of note.	No recent fires of note.	Hepsie Fire, 42 acres on Rogue River, LSR 227, 1996.
Special forest products[8]	Madrone burls, Sugar pine shake bolts.	Commercial mushroom permits exist--an issue with Crater Park. Also commercial bough permits.	Christmas tree permits, mushrooms, boughs. Rogue is part of 4 forest mushroom permit.	Christmas tree permits, mushrooms. Winema is part of 4 forest mushroom permit system.
Recreation Uses	not applicable.	Hammaker CG. Trail to Crater Falls. Snow park site.	See Developments.	Lake of the Woods Rec. Area. Summer and winter Rec. trails.
Research	Progeny sites need thinning in 10-15 yrs. Need to be able to clear around 30 "plus" trees.	Anderson evaluation plantation. Fisher research on-going in RNA. Monitoring Peregrine site, owl monitoring. Carleon research in EUI contract.	Ongoing long-term timber PNW monitoring, Bessie Shelter area. 2 or 3 evaluation plantations, and 1 seed orchard. Fisher research on-going. Owl regional monitoring.	One seed orchard and a Western larch provenance test site. Select trees located throughout the LSR. Spotted owl (F. Wagner, OSU; G.Sitter, BLM; Great gray owl surveys; AROS root rot; fire history, large woody material studies. Herptile study adjacent to LSR.
Rights-of-Way, Contracted Rights, Easements, Special Use Permits	Proposed dam for flood control on Elk Cr. is half-built, currently on hold due to fish blockage issue. Two 250KV power lines go through LSR.	Horse race event. Cross country trail race.	One small dam (South Fork), for power. Bessie Shelter used by permit holders.	Klamath RD averages 8 short-term event permits/yr.
Nonnative Species	See Elk Cr. WA.	Tansy ragwort, spotted knapweed.	Spotted knapweed possibly. Nonnative species are outcompeting native grasses and plants.	Toadflax, knapweed, and St. Johns wort.

[8] Activities need to be evaluated for effects on LSR objectives, see ROD C-18.

INDIVIDUAL LSR CONTEXT

LSR 224

This LSR is made up primarily of Medford Bureau of Land Management lands with a small component of land on the Rogue River National Forest. The elevation ranges approximately from 1500 feet to over 4000 feet. Lands not capable of supporting late seral conditions comprise a small, but unknown percent of the area.

Existing Conditions

This area has approximately 43.3 percent of the land in late seral conditions, but only a very small percent in interior habitat. Most of the late seral stands are in the White Fir Series. Forty-nine percent is considered nesting, roosting, or foraging habitat (Table 8).

Species

Elk Creek supports populations of coho and chinook salmon and steelhead. This LSR presently supports 30 northern spotted owl activity centers. Only 6 activity centers have greater than 40 percent of their home range as suitable owl habitat. Other animals of interest include the Fisher. Plant species of interest include Baker's Cypress, and Pygmy monkey- flower. Habitat diversity is increased at the lower elevations by oak woodlands and dry meadows; rocky bluffs are present at the highest elevations.

Surrounding Ownership and Land Allocations

Adjacent lands include Forest Service and Bureau of Land Management matrix lands to the west, south, and east. To the north, the Rogue River National Forest is allocated to LSR. Several sections of Rogue River National Forest land are located inside the LSR, yet designated as matrix land. Other ownership's include commercial forest land (Boise Cascade), private land and county lands.

Connections

Important to this LSR is Elk Creek, which serves as a connection between the Rogue River and the upper elevations of the area. The northern boundary of this LSR is adjacent to the southern boundary of LSR 222, extending the transition connection between the southern Mediterranean climate and the mesic climate characteristic of the area north of 222. Older forest habitat connections are often broken by early seral patches. The area between LSR 224 and LSR 223 to the west is part of an area that was identified by the Interagency Scientific Committee (Thomas, 1990) as an area of concern wherein Northern Spotted Owl dispersal capabilities should be a management priority.

Connectivity "hotspots" become apparent when viewing larger scale maps. The distribution and juxtaposition of seral stages within the BLM administered "checkerboard" land is perhaps not good enough to allow the LSRs to fully function as habitat reserves for the full array of late successional species known to exist in the assessment area. These areas are not necessarily currently incapable of providing for dispersal of species such as spotted owls, but due to the relatively high percentage of early seral stands, movement of less mobile species across these areas is probably precluded.

Geology and Climate

This LSR is characterized by mountainous terrain with long rounded ridgetops, steep slopes, and moderate to high stream gradients. Climate is Mediterranean, with cool moist winters, and hot, dry summers with extended periods of drought. Growing conditions are slowed by low precipitation during the summer.

EXISTING VEGETATION

PLANT SERIES

Plant series is a major stratification of habitat. Series are named after the dominant climax plant species. For example, the Western Hemlock Plant Series will grow to be dominated by large western hemlock if undisturbed by fire, floods, slides, etc. Series is an expression of site potential and provides the basis to determine the desired future condition of late seral plant communities. The Series have characteristic disturbance regimes and associated patch dynamics. Series also provide information on specific structures and species composition.

Forests of the South Cascades LSR Network are comprised of at least ten series (Table 9). The most common are Western Hemlock (42 percent of area), White Fir (24 percent of area), and Douglas-fir (12 percent of area) (McCrimmon and Atzet 1990). Less well represented series are Silver Fir, Shasta Red Fir, Mountain Hemlock, Western Redcedar, Oregon White Oak, Lodgepole Pine, and Ponderosa Pine.

The LSR network in this assessment spans a wide range of environments, and this is reflected by the many plant series that are represented (Map 3). The northern portion of LSR 222 is predominantly Western Hemlock Series, reflecting a cool, moist climate. Western Redcedar Series is present in the wettest areas. The Silver Fir Series occurs at the highest elevations. East of the Calapooya Divide a rain shadow appears to exist; here, as well as in other dry areas, the Oregon White Oak Series and Douglas-fir Series occur in small pockets. In the southern portion of LSR 222, and LSR 224 the Western Hemlock Series is replaced by the White Fir Series. Douglas-Fir Series becomes more dominant and the Oregon White Oak Series occurs more frequently. In LSR 227, Douglas-fir predominates at the low elevations and transitions to White Fir Series as the elevation increases. Along the crest of the Cascades and eastward, the Shasta Red Fir Series becomes dominant, with pockets of Lodgepole Pine and Mountain Hemlock Series east of the Cascades. LSR 226 is predominantly a mix of White Fir and Western Hemlock Series to the north, and White Fir Series in the south. Shasta Red Fir Series becomes dominant as elevation increases, and Mountain Hemlock Series occurs at the highest elevations. LSR 225 is similar to LSR 226; a mix of Western Hemlock and White Fir Series predominates at the lower elevations, with Shasta Red Fir Series occurring at higher elevations, and Mountain Hemlock Series at the highest elevations (See Map 3).

CHAPTER 4: DESIRED FUTURE CONDITIONS

INTRODUCTION

Late-Successional Reserves are designed to maintain a functional, interacting, late-successional and old-growth forest ecosystem (ROD, C-11). This assessment makes the assumption that if the structural components are in place, the ecological processes and functions associated with late-successional forest ecosystems will continue. These structural components include large trees, multiple-canopy stands, snags, down wood, logs in streams, and small openings.

Time is an important element in the health of the late-successional forest. For example, where areas of large trees, snags, and down wood are lacking due to past practices, the LSR allocation, allowing as it will the growth of forest stands over time, will tend to increase those components. Nevertheless, the overall goal for Late-successional Reserves as stated in the ROD takes an active managerial stance to “protect and enhance” the Reserves.

The desired future conditions described in this assessment will not be attained for many decades, or possibly more than a century. The amount of treatments proposed for exemption from further REO review, or the amount of projected treatments overall, are not intended to represent the long term activity levels needed to reach desired future conditions. The natural growth and evolution of forest stands and habitat over time will be a major factor in attaining desired conditions. Projected amounts of treatment are intended to represent a conservative management approach based on the limits of existing data and experience in managing for late-successional conditions.

Two desired future conditions were developed by the South Cascades LSR Assessment team that follow directly from the overall goal and the existing conditions: one for the amount of late seral forest, and one for the amount of high fire risk fuels. These were judged to be specific, measurable, and directly related to LSR objectives.

DESIRED FUTURE CONDITION FOR LATE SERAL VEGETATION

Terrestrial areas in LSRs 222, 225, 226, and the western portion of 227 have a desired condition of 75 percent late seral vegetation. This drops to 55 percent in LSR 224, and 50 percent in the eastern portion of LSR 227.

Riparian reserves in these LSRs have a desired condition of 75 percent late seral vegetation. There may be riparian reserves adjacent to smaller, intermittent streams that cannot maintain this level of late seral vegetation due to fire regimes and site character (e.g. LSR 224). Administrative units should address this issue during the watershed analysis process.

Stands include large trees, snags, canopy gaps, patchy understory for developing multiple canopy layers, large woody material, and future understory trees. While the percentage of late seral vegetation is the measurable objective, the following are also included as components of the desired condition:

Vegetation structure and pattern are diverse

Forest vegetation structure and pattern are diverse. Patch size, plant species composition, and other late successional characteristics meet the habitat requirements for late successional associated species. Forest and riparian reserve vegetation structure and pattern contribute to landscape level land management objectives.

Habitat for early/mid successional species is maintained

Habitat for early and mid-successional species is maintained when LSR populations of those species are important for viability of the species over a broader geographic area, or if any of those species should be locally endemic to these LSRs. This is appropriate for special habitats, such as meadows, or where development of habitat for late-successional species is not substantially delayed. Otherwise, most early/mid successional species habitat is expected to be maintained outside of LSRs.

Connectivity exists between and within watersheds

Connectivity of terrestrial, riparian, and aquatic conditions is promoted between and within watersheds. Late seral vegetation provides connected and resilient watershed processes within and between watersheds. Within watersheds, the terrestrial, riparian and aquatic system are connected. Aquatic systems consist of a diversity of species, populations, and communities that may be uniquely adapted to these specific structures and processes.

LSRs offer protection for all stream types, and provide core areas of high quality stream habitat. Figure 14 describes general riparian and stream conditions in properly functioning watersheds (See Appendix A).

Snags and down wood levels maintain species diversity

Levels of snags and down wood are high enough, variable enough, and change enough, in time and space, to maintain site productivity and species diversity in terrestrial, riparian, and aquatic communities. Abundance and distribution of snags and down wood ameliorates changes in habitat condition and climatic anomalies.

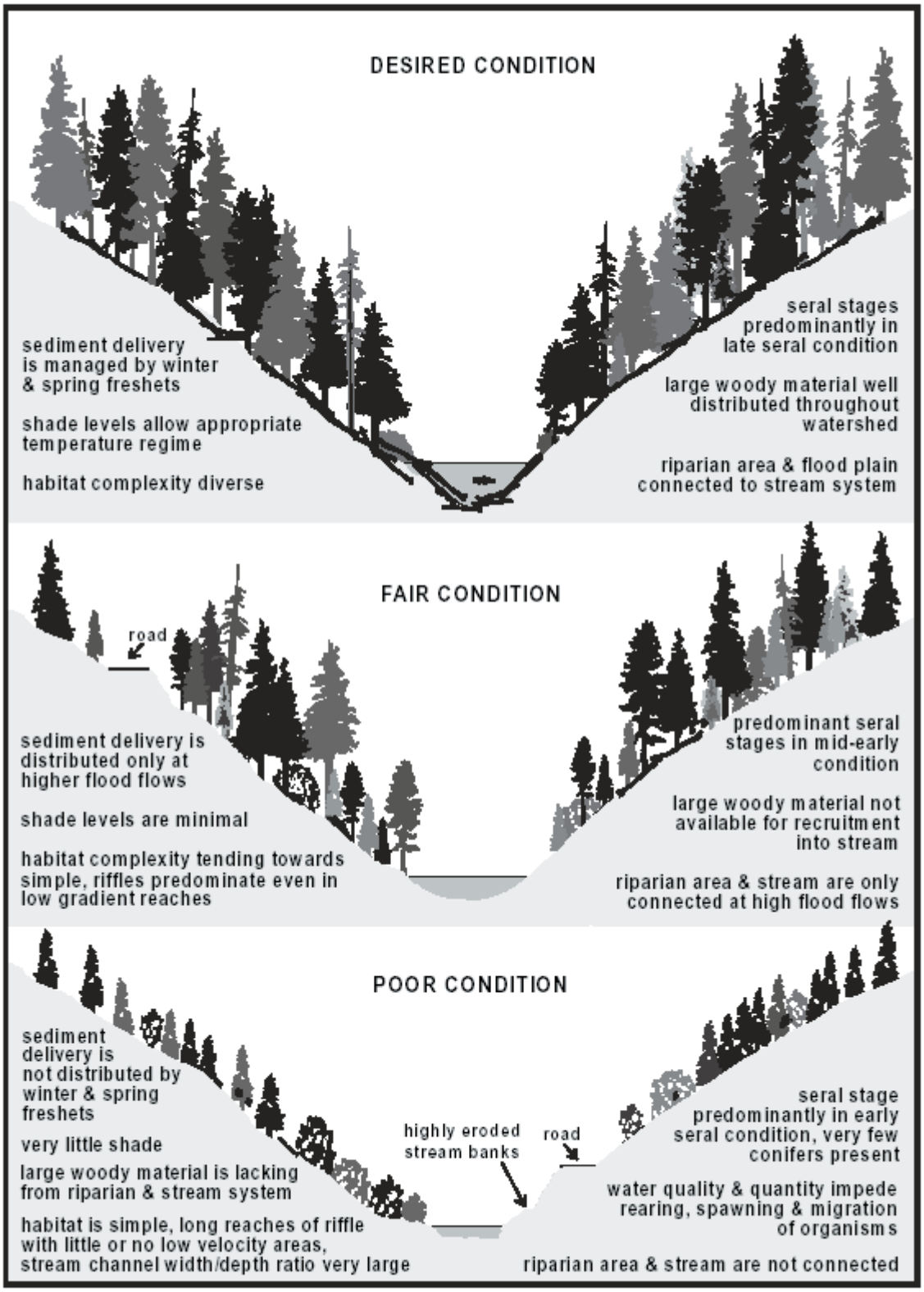
Terrestrial habitats maintain healthy, source populations of late seral and old growth associated species

Patch size, amount of interior habitat, plant species composition, and other late seral characteristics offer core areas of high quality habitat. High amounts of source and refuge habitats for late seral and old growth associated species are found throughout the landscape.

Wet area habitats maintain high levels of source populations

Aquatic and terrestrial habitats of native species dependent on wet areas are restored and maintained. Structures and processes are in place to maintain high levels of source populations (ROD, B-11).

Figure 14: Riparian Conditions



Rationale for Late Seral DFC

Historic amounts of late seral habitat have been estimated for southwestern Oregon, and range from 40 to 70 percent (REAP, 1994). The assessment team assumes that late seral processes were functioning in this range. These estimates are for the total landscape. Since harvest will now be concentrated in non-LSR areas, these areas will contain substantial amounts of early and mid-seral forest. Further, the focus of LSRs is to enhance late seral habitat. Therefore, the high end of the historic range is recommended as a DFC for these LSRs. The Visual Dynamics Development Tool (VDDT) was used to verify the estimates of sustainable late seral vegetation in these LSRs (Appendix H). Those results show that the DFCs listed above are reasonable for each LSR overall. However, there is a wide range of sustainability within each LSR. The numbers are used to compare LSRs and watersheds. They are not to be used for every stand or area.

Indicators for Late Seral DFC

Percentage of capable, terrestrial LSR acres in late seral condition.
Percentage of capable, riparian reserve LSR acres in late seral condition.

Indicators will be displayed by LSR and fifth field watershed. Data source for both is the seral map produced from a satellite vegetation size/structure pixel layer for Forest Service lands and the Forest Operations Inventory and MICROSTORMS for BLM lands. See Appendix D for classification assumptions.

DESIRED FUTURE CONDITION FOR HIGH FIRE RISK FUELS

No more than 28 percent of LSR acres are in high fire risk condition at any one time. Stands that develop after fire include large trees, snags, canopy gaps, patchy understory for developing multiple canopy layers, large woody material, and future understory trees. While the percentage of high risk fuels is the measurable objective, the following is included as part of the desired condition:

Features of the natural disturbance regime are maintained

Fire return intervals, stratified by geographic area and aspect, should approximate those found in Table 22, and be representative of natural disturbance regimes, to the extent practicable.

Wildfires, when they occur, are low to moderate intensity over about 75 percent of the area. Features of the natural disturbance regime operate at levels that maintain species, habitat diversity, and encompass less than natural levels of stand replacement events.

Large blocks of late seral habitat have fire risk levels that approximate those prior to the advent of fire exclusion.

CHAPTER 5: TREATMENT CRITERIA AND NEEDS

TREATMENTS AND CRITERIA TO REDUCE RISKS OF LARGE-SCALE DISTURBANCE

INTRODUCTION

Prescribed burning is considered a silvicultural treatment, and may be beneficial to the creation of late-successional forest conditions (ROD, C-12). Prescribed fire, or other risk management activities, should occur first in the high risk areas. There are four categories of activities to lower risk and reintroduce fire into South Cascades LSRs (TABLE 53):

- Reduce large scale fire risk with the creation of shaded fuel breaks;
- Reduce the amounts of high risk fuels in stands under 80 years old;
- Reduce the amounts of high risk fuels in stands over 80 years old;
- Reduce moisture competition for large pine in stands over 80 years old.

REDUCE LARGE FIRE RISK WITH FUEL BREAKS

Objective

The objective is to protect large blocks of late seral habitat from, and minimize the risk of, large scale fire; while minimizing treatment risk to that habitat. Another objective is to increase the ability to safely and effectively conduct initial attack fire control activities. It is not the intent of fuel breaks to remove all LWM. The objective is to focus on the reduction of smaller fuels and to create conditions that lower the intensity of fire approaching the fuel break.

Negative short-term effects to late-successional forest-related species are outweighed by the long-term benefits to such species and will not lessen short-term functionality of the LSR as a whole.

Agencies having an interest in LSR projects proposed under these criteria should continue to be given the opportunity to participate in project development.

Timber volume production is only incidental to these objectives and is not, in itself, one of the objectives of the treatment. Creation or retention of habitat for early successional forest-related species is not a treatment objective.

Appropriate Treatments

Young stand thinning, density management, and/or prescribed fire are all appropriate activities to meet fuel break objectives.

Landscape Criteria and Priorities

Fuel break treatments will occur first in the high fire risk areas. Two components, fuel models and fire behavior, have been combined to help determine where that risk is high. Map 8 displays these high risk areas. Verification of high risk fuels will be needed in the watershed preattack, or equivalent plan.

The fuel breaks are intended to break the high risk area into 4000-6000 acre blocks, thus

reducing the risk of a large scale incident burning even larger watersheds. Figure 17 shows the intended size of blocks to protect across the landscape. It is not intended as an exact display of actual locations. Watershed level or project preattack, or equivalent plans will propose actual locations.

Fire behavior is the most important component. Fire occurrence may vary over time due to changes in lightning and recreation patterns. Due to this changing pattern, and practical treatment operations, treatment should not be precluded in areas of low-moderate risk if fire behavior is indicated as high.

Implementation of fuel breaks within late seral stands would result in habitat degradation within the fuel breaks and increase the amount of edge in cases where the fuel breaks go through intact stands. This impact would not be as great in cases where the fuel breaks go along existing edges of intact stands. Therefore, avoid locations which would split large blocks of late seral habitat. Place fuel breaks only along the edges of significantly large patches of late seral habitat/suitable NRF where a high risk of large scale loss exists.

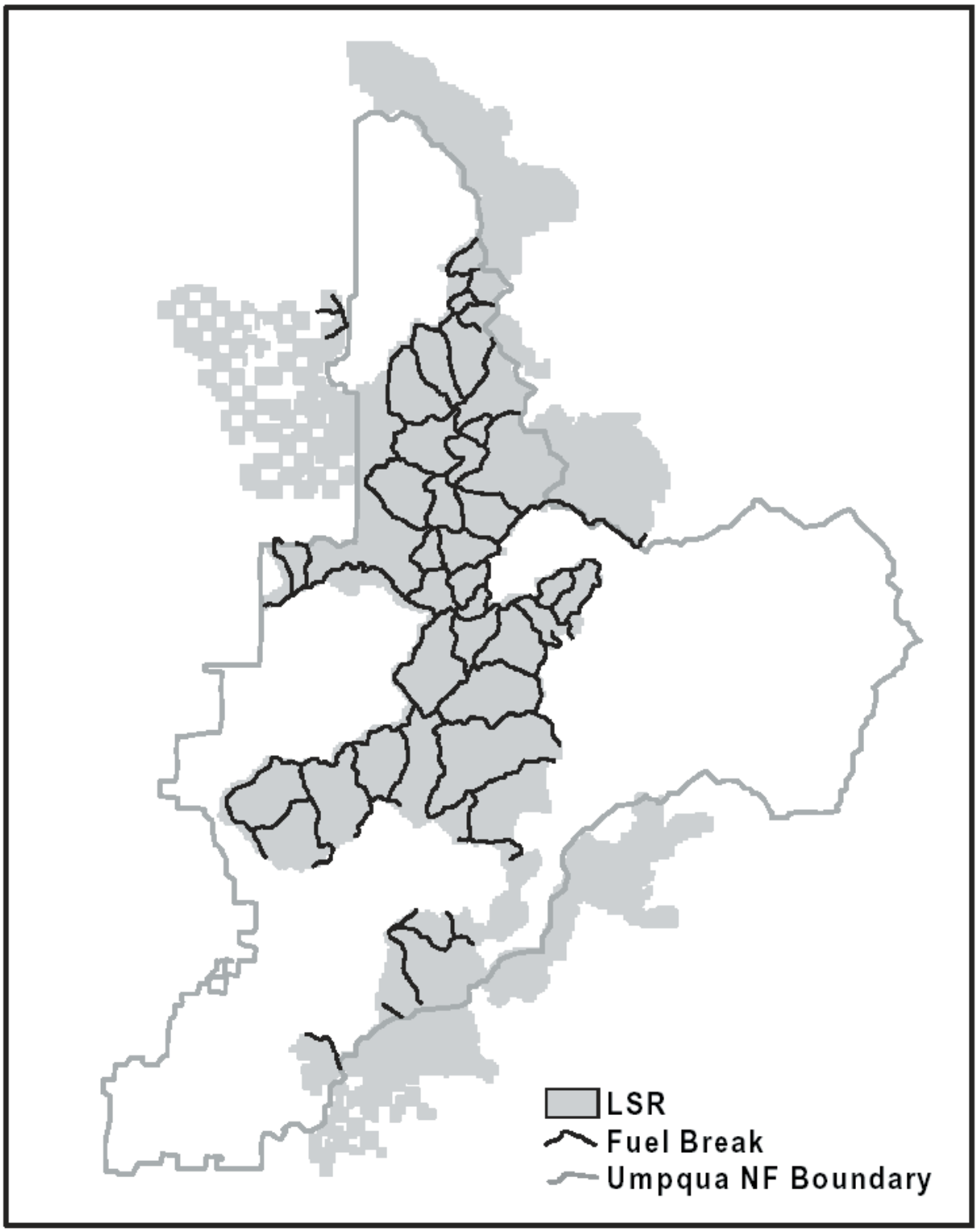
Attempt to locate fuel breaks on the landscape near concentrations of early or mid-seral stands. Where spotted owl dispersal habitat is heavily dependent on concentrations of mid seral stands that are also candidates for fuel break treatment, do not concentrate these treatments in time, but spread out these treatments to minimize possible short-term impacts to dispersal habitat.

Give priority to treatment near the rural interface and high density recreation areas.

Give priority to treatment in or near recent stand replacement events. See also the Salvage section.

See also section on Treatment Amounts for “between watershed” priorities and additional consideration of tradeoffs between treatment and late seral habitat.

Figure 17: Landscape Fuel Break Locations (Example: Umpqua National Forest within LSR)



Stand Criteria

Fuel Break Width

The fuel breaks should be approximately 400 feet (horizontal distance) wide and located on defendable ground, such as roads and ridgetops. For practical reasons, fuel break treatments may go through pockets of less than high fire risk. Figures 10-12 display the desired stand condition after treatment.

Interlacing Crowns and Understory Trees

Where there are interlacing crowns, remove only those green trees needed to eliminate the interlacing. Thin understory to a spacing of not less than six feet between crowns.

Prescribed Burning

Where fuel breaks are created using young stand thinning or density management, follow those treatments with prescribed burning within the fuel break.

LWM Guidelines

LWM guidelines in fuel breaks are determined by levels of acceptable fuel risk. Leave LWM in the following ranges:

- in 0-9” diameter material, leave 2-10 tons per acre;
- in 9-20” diameter material, leave 10-15 tons per acre; and,
- in 21”+ diameter material, leave 5-10 tons per acre, for a total of 17-35 tons per acre, where this material does not compromise the integrity of the fuel break.

Brush Piles

For connectivity, provide dispersed, variable spaced small piles (3-5 feet high and 6-10 feet in diameter) where they do not compromise the integrity of the fuel break. Hand-piling small (<9”) fuels into well-dispersed brush piles will provide habitat for various small mammals, birds, reptiles, amphibians, arthropods, fungi, mosses, lichens, bacteria and viruses. A wide variety of life forms respond favorably to the presence of concentrations of woody debris; hiding, denning and nesting cover, as well as foraging opportunities are afforded there. Providing those habitat values via the management of dispersed brush piles in ridge top fuel breaks greatly increases the probability that many of the species associated with late seral forests will be able to successfully negotiate and cross, if not forage, or even place a den or nest there.

Snags and Stumps for Bats

Since large snags are the best habitat, do not cut them all. Meet fuel break requirements, yet leave some of the largest snags. It has recently been learned through radio-tracking studies that several species of forest-dwelling bats utilize large snags on ridges. They are apparently drawn to these structures because of the favorable temperature regimes afforded within. Snags on ridges, especially the larger, taller ones intercept significantly greater amounts of solar radiation than do similar sized snags on lower slope positions. The larger a snag is the more solar radiation it can directly intercept and the lower its surface area-to-volume ratio is, which results in a slower rate of heat loss. These larger ridge top snags can provide thermally advantageous roosting and maternity colony sites that smaller ridge top and similar-sized but lower slope position snags cannot.

When cutting snags or trees on ridgetops, cut stumps as high as reasonably possible. It has also been recently learned that stumps with adequate amounts of thick bark (usually Douglas-fir) located where they are exposed to direct sunlight, can provide roosting sites for bats. Thermal advantages similar to those seen in ridge top snags seem to be present in these stumps. It is the crevices within and behind the thick bark that the bats are using. The taller a stump, the more it offers the same type of niches as do the snags. Hence, the recommendation that any large trees or snags needing to be felled get cut off as high above ground as is reasonably possible.

Emphasizing the retention of the largest snags available, where the snag does not compromise the fuel break integrity, as well as sawing trees and snags far above the ground, will greatly decrease the negative affects the establishment of these fuel breaks might otherwise have on forest-dwelling bats.

Large Hardwoods

Emphasize the retention of large hardwoods in ridge top fuel breaks. The retention of large hardwoods in ridge top fuel breaks is emphasized because of their general longevity and propensity to form cavities. Numerous forest-dwelling species directly and indirectly depend on natural cavities in trees; many of those species are not only associated with late seral forests, but play integral roles in forest ecology. Where the cavity-prone large hardwoods are present, or are likely to be present in the future if smaller hardwoods on site are retained, emphasize their retention.

Nonnative Plants and Noxious Weeds

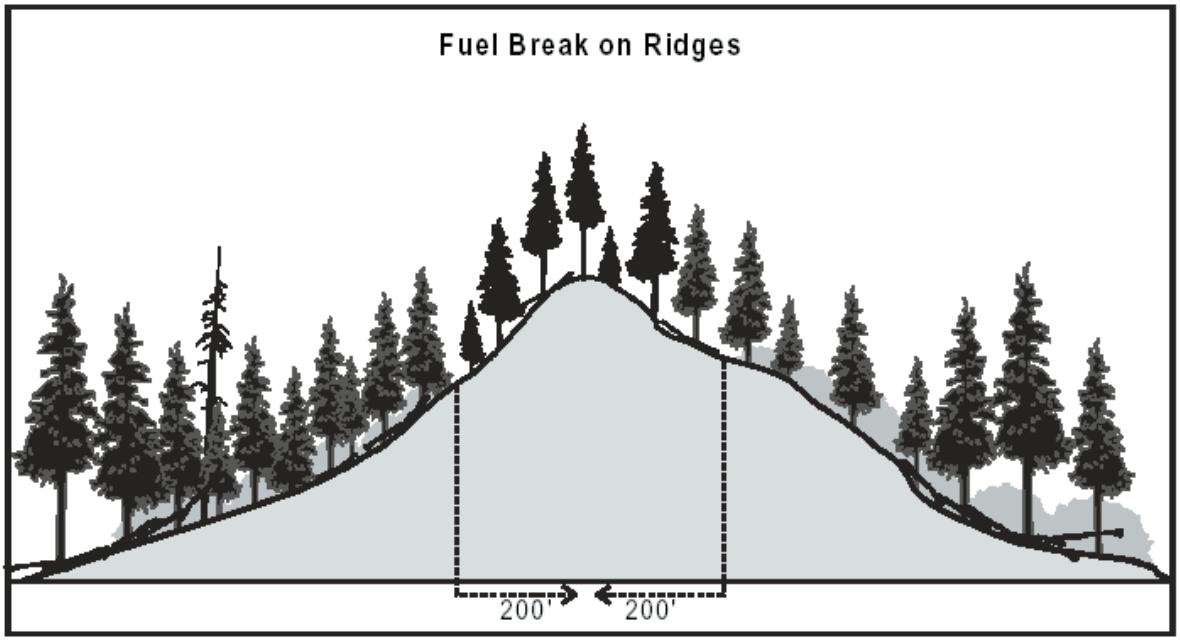
Avoid direct and indirect introduction of nonnative plants and noxious weeds. If it is determined that it will be beneficial to establish vegetation on a fuel break, use only local, native seed sources.

Ground-breaking equipment used in the preparation and maintenance of these fuel breaks should be thoroughly washed, outside of the LSR, before being brought to the work site.

Fire Management Plan

The Fire Management Plan included in this assessment provides additional criteria for fire and fuel related activities.

Figure 18: Desired Stand Conditions Following Fuel Break Treatment



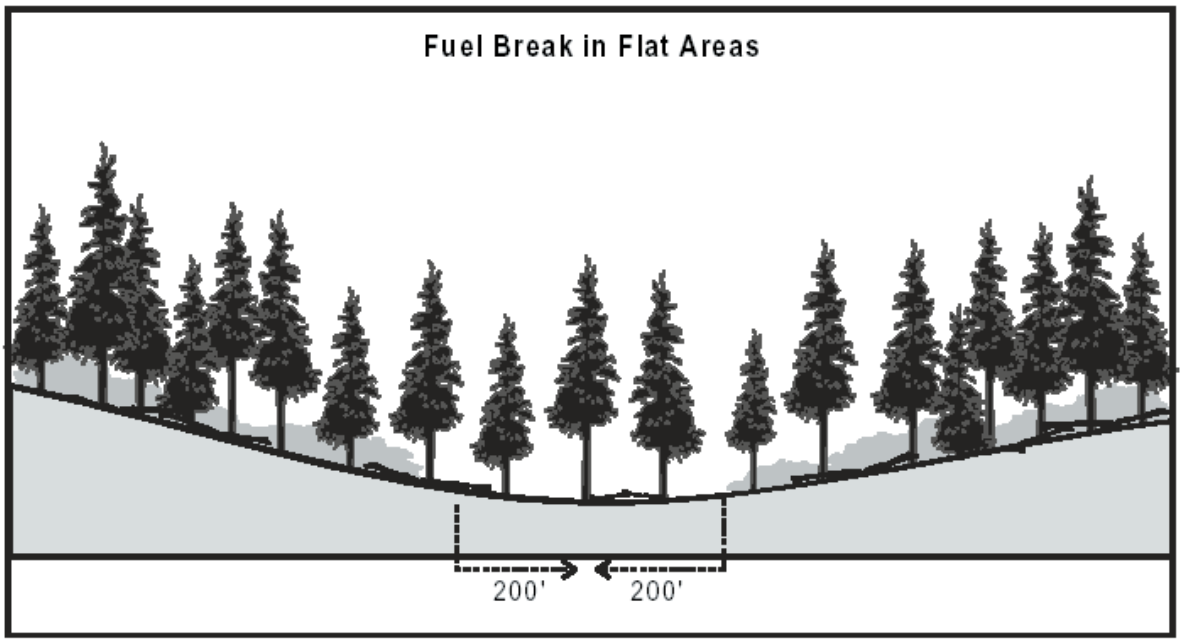


Figure 19: Desired Stand Conditions Example 2

Figure 20: Desired Stand Conditions Example 3

Treatment Amounts and Implementation Schedule

Estimate of Maximum Treatment Area

An estimate of the maximum extent of fuel break treatments on the LSR landscape was assessed by a GIS procedure. The size of blocks to protect by fuel breaks was considered by the core team to be roughly equivalent to the sub-basin layer on the Umpqua National Forest, about 6,000 acres (Figure 17). These watersheds are smaller than the fifth-field watersheds (HUC5), and larger than HUC6 watersheds. The watershed boundaries are generally on ridgetops, where most of the fuel breaks are expected to be placed. In addition, fuel breaks are most feasible along existing roads. Therefore, 200' buffers were placed along each side of sub-basin watershed boundaries, and intersected with roads, high fire risk areas, late seral vegetation, and suitable owl habitat. This results in a very high estimate, since funding levels, access, and other ecological and practical project considerations will necessarily limit the amount of this treatment. However, it does provide a first estimate of the maximum amount that might be done for the purposes of estimating potential impacts of the treatment. The results from the Umpqua are extrapolated to the rest of the LSR network proportional to LSR size (Table 45).

The amounts in Table 45 are exempted from further REO for a period of five years. For tracking purposes, these amounts are displayed by LSR administrative unit. If proposed treatments would exceed the amount listed by individual LSR administrative unit, coordination with other units in that LSR will be needed to assure that the amount listed as exempt from REO review is not exceeded for that LSR as a whole.

Table 45: Estimate of Maximum Fuel Break Treatments

LSR	LSR Total Acres	Maximum Treatment Acres	Amount Per Year Exempt from Further REO Review
222, Eugene BLM	21,200	800	50
222, Roseburg BLM	25,500	900	50
222, Umpqua NF	342,800	13,100	700
222, Willamette NF	93,300	3,600	180
222, Rogue River NF	25,200	1,000	50
224, Medford BLM	21,500	800	50
225, Rogue River NF	39,800	1,500	75
226, Rogue River NF	49,800	1,900	100
227, Rogue River NF	52,800	2,000	195
227, Winema NF	48,800	1,900	41
Total	**720,700**	**27,500**	**1450**

Treatment Habitat Impacts

There are approximately 16,000 acres within a 400 foot wide strip centered on the ridges which delineate the recognized subbasins on the Umpqua portion of LSR 222. Full implementation of the fuel break prescription in all high and moderate fire risk acres in that strip would result in a total of approximately 13,500 acres being treated. Of that 13,500 acres of moderate and high fire risk, 7500 acres are currently considered to be suitable NRF habitat (3.6 percent of all NRF in the Umpqua portion of LSR 222), and 5200 acres are classified as late seral (3.5 percent of all late seral stands in the Umpqua portion of LSR 222). Implementation of the fuel break prescriptions in late seral stands would result in habitat degradation within the fuel breaks and it would increase the amount of edge in cases where the fuel breaks go through intact stands. This impact would be not be as great in cases where the fuel breaks go along existing edges of intact stands. In addition, rather than constructing a large network in only a few years, spreading the construction of fuel breaks over time would lessen the impact.

Research conducted within and adjacent to the South Cascades LSR network indicates that spotted owls avoid suitable NRF that has been “degraded”. This effect appears to last for decades. Because of the potential to degrade 3-4 percent of the currently suitable NRF (at least within the Umpqua NF portion of LSR 222) and, because fragmentation of late seral stands is a regionally recognized concern, it is recommended that fuel breaks not be located where large blocks of late seral stands would be split. Also, it is recommended that fuel breaks only be placed along the edges of significantly large patches of late seral habitat/suitable NRF where a high risk of large scale loss exists.

The overall extent of the impact to current amounts of NRF and late seral stands that would result from full implementation of the fuel break concept as proposed on the Umpqua portion of LSR 222 is difficult to estimate because the information required for the analysis was not readily available from the other administrative units. Because of this, the effects of implementing a fuel break proposal similar to the one used in the example for the Umpqua NF portion of LSR 222 could not be evaluated. However, an estimate extrapolated from the Umpqua portion is provided in Table 45.

Reduce Fuel Loading In Stands Under 80 Years

Objective

The objective is to make stands less susceptible to large-scale disturbances while accelerating development of late-successional conditions and minimizing treatment risk to late seral habitat.

The objective is to increase the ability to safely and effectively conduct initial attack fire control activities. The objective is to focus on the reduction of smaller fuels.

Prescribed burning is intended to reintroduce fire into the ecosystem in high risk areas on the upper third of slopes with the objective of reducing the risk of large scale stand replacement fires.

With the use of these treatments, fuels across the landscape will begin to approximate amounts typical of pre-fire exclusion conditions, and the potential for large scale disturbance will be reduced.

Negative short-term effects to late-successional forest-related species are outweighed by the long-term benefits to such species and will not lessen short-term functionality of the LSR as a whole.

Agencies having an interest in LSR projects proposed under these criteria should continue to be given the opportunity to participate in project development.

Timber volume production is only incidental to these objectives and is not, in itself, one of the objectives of the treatment. Creation or retention of habitat for early successional forest-related species is not a treatment objective.

Appropriate Treatments

Appropriate treatments to reduce fuel loading include young stand thinning, density management, and/or by the use of prescribed fire.

Landscape Criteria and Priorities

Treat areas of high fire risk fuels or east of the Cascades in LSR 227 (Map 8).

Treat where the highest probability exists of high intensity wildfire spreading into late seral habitat.

Identify high priority blocks for treatment.

Prescribed burning projects should be planned in such a way that present year projects are adjacent to past year accomplishments. In this way, large areas will benefit from the reintroduction of fire. A scattering of small areas would not be as effective.

Priority will be younger stands, dry sites (90-270 degree aspects, upper slopes), plant series with pines, and areas adjacent to fuel breaks.

Treat around, but outside of, owl activity centers to minimize future risk to core from fire disturbance.

Stand Criteria

For young stand thinning, use REO exemption criteria 4/20/95.

For density management, use REO exemption criteria 7/9/96. Per REO exemption letter, avoid thinning where mid-seral stands under 80 years old are, or soon will be, nesting, roosting, and foraging habitat.

See also root disease guidelines, page 138.

For prescribed fire, also follow guidelines from prescribed fire plan.

Use Snag and LWM criteria, page 130.

Treatment Amounts and Implementation Schedule

Of the 192,000 acres of early/mid seral stands estimated to be in high fire risk areas, treat 54,000 acres (upper third of slopes) over a 20 year period, or 2700 acres per year (Table 46).

These amounts are exempt from REO review for a period of five years. For tracking purposes, these are displayed by LSR administrative unit. If proposed treatments would exceed the amount listed by individual LSR administrative unit, coordination with other units in that LSR will be needed to assure that the amount listed as exempt from REO review is not exceeded for that LSR as a whole.

Note: Treatments in this assessment are organized by primary objective. As such, there are significant overlaps between these acres and those identified elsewhere in this assessment. Specifically, there are overlaps with stands under 80 years old identified with a primarily objective of density management, and with stands under 80 years old with a density management emphasis in pine stands.

Table 46: Estimate of Fuel Reduction Treatments in Stands Under 80 Years Old

LSR	LSR Total Acres	Early/Mid Seral, High fire Risk	Proposed Treatment Upper Third	Amount Per Year Exempt from Further REO Review
222, Eugene BLM	21,200	7,100	1,600	80
222, Roseburg BLM	25,500	8,200	2,300	115
222, Umpqua NF	342,800	80,500	24,200	1210
222, Willamette NF	93,300	20,600	5,900	295
222, Rogue River NF	25,200	10,200	2,700	135
224, Medford BLM	21,500	9,000	1,700	85
225, Rogue River NF	39,800	14,000	4,000	200
226, Rogue River NF	49,800	15,100	4,000	200
227, Rogue River NF	52,800	13,700	3,900	195
227, Winema NF	48,800	14,000	3,400	[42]
Total	**720,700**	**192,400**	**53,700**	**2515**

[42] See the Winema NF LSRA for treatments, criteria, and REO exemptions.

Reduce Fuel Loading In Stands Over 80 Years

Objective

The goal of prescribed burning in the LSRs is to:

1. Protect or enhance stand conditions for old growth associated species, and
2. Reduce the risk of large scale, high intensity disturbances.

Prescribed fire is recognized as a valuable tool to meet LSR objectives, especially in southwest Oregon where fire is such an integral part of ecosystems function. With the use of these treatments, fuels across the landscape will begin to approximate amounts typical of pre-fire exclusion conditions, and the potential for large scale disturbance will be reduced. Reducing the potential for large scale disturbance will lower smoke emissions, and reduce the cost of wildfire suppression.

Negative short-term effects to late-successional forest-related species are outweighed by the long-term benefits to such species and will not lessen short-term functionality of the LSR as a whole.

Agencies having an interest in LSR projects proposed under these criteria should continue to be given the opportunity to participate in project development.

Appropriate Treatments

Both management ignited and naturally ignited prescribed fire are appropriate methods.

Landscape Criteria and Priorities

Treat areas of high fire risk fuels or east of the Cascades in LSR 227 (Map 8).

Treat to protect the largest blocks of late seral habitat. Where areas of fire refugia are identified in watershed analyses, fire is not recommended.

Focus treatments in areas furthest removed from known owl sites.
Prescribed burning projects should be planned in such a way that present year projects are adjacent to past year accomplishments. In this way, large areas will benefit from the reintroduction of fire. A scattering of small areas would not be as effective.

Priority will be younger stands, dry sites (90-270 degree aspects, upper slopes), plant series with pines, and areas adjacent to fuel breaks.

Stand Criteria

For prescribed fire, follow guidelines from prescribed fire plan.

Maintain variability within stand. Application of prescribed fire will vary in extent and frequency of application, and intensity of burning. The variability in applications should be related to the fire return intervals for the specific area, current ecosystem needs, and the wildfire risk analysis contained in this assessment.

Treatments will focus on the reduction of smaller fuels. The objective is not elimination of LWM.

Both types of ignition need a project specific prescribed burn plan that meets current agency direction. In addition, a prescribed natural fire plan must be approved prior to the use of naturally ignited prescribed fire.

Prescribed fire operations will implement the same suppression guidelines as wildfire suppression activities to minimize adverse impacts to late-successional habitat.

Prescribed fire projects and prescriptions will be designed to contribute to attainment of aquatic conservation strategy objectives.

Keep as many large trees as possible, i.e. keep the percentage of the burned area below 15 percent in high intensity fire behavior and create snags, canopy gaps, and patchy understory for developing multiple canopy layers, large woody material, and future understory trees.

The stand is at risk due to an overstocked understory, or is in an area where fire exclusion has increased fuel loading to the point of potential extreme fire behavior.

A number of treatments may be utilized to reduce fuel loading and reduce the risk of large scale fire. Underburning could be used where stand densities, presence of ladder fuels, and fire intolerant species don't make it impractical. In cases where underburning is impractical, hand piling of fuels can be used to reduce the risk of stand replacement fire, when high fuel loads are concentrated in contiguous stands. These treatments should be designed to retain an adequate amount of large woody material. The upper third of southerly slopes should receive priority for treatment. Sufficient snags of various species and size should be retained to ensure future recruitment of large woody material.

Treatment Amounts and Implementation Schedule

Of the 189,000 acres of late seral stands estimated to be in high fire risk areas, treat 48,000 acres (upper third of slopes) over a 20 year period, or 2400 acres per year (Table 47)

These amounts are exempt from REO review for a period of five years. For tracking purposes, these are displayed by LSR administrative unit. If proposed treatments would exceed the amount listed by individual LSR administrative unit, coordination with other units in that LSR will be needed to assure that the amount listed as exempt from REO review is not exceeded for that LSR as a whole.

Table 47: Estimate of Fuel Reduction Treatments in Stands Over 80 Years Old

LSR	LSR Total Acres	Late Seral, High Fire Risk	Proposed Treatment upper Third of both North and South Slopes	Amount Per Year Exempt from Further REO Review
222, Eugene BLM	21,200	7,300	1,600	80
222, Roseburg BLM	25,500	11,100	2,400	120
222, Umpqua NF	342,800	110,600	29,200	1460
222, Willamette NF	93,300	24,900	6,400	320
222, Rogue River NF	25,200	5,600	1,400	70
224, Medford BLM	21,500	7,600	1,700	85
225, Rogue River NF	39,800	6,100	1,400	70
226, Rogue River NF	49,800	6,100	1,300	65
227, Rogue River NF	52,800	4,500	1,000	50
227, Winema NF	48,800	5,300	1,300	[43]
Total	**720,700**	**189,100**	**47,700**	**2320**

[43] See the Winema NF LSRA for treatments, criteria, and exemptions.

Risk Management in Stands Over 80 Years with Pine

Objectives

The objective of treatments is to reduce moisture competition to favor the native pine species. This will serve to maintain the seral pine component and associated habitat by enhancing the vigor of trees. This will help avoid undesirable losses due to bark beetles. See also applicable objectives in the 7/9/96 REO exemption criteria.

Appropriate Treatments

Remove competing vegetation not exceeding 24” diameter near important dominant and predominant pines.

Landscape Criteria and Priorities

In the South Cascades LSRs, pines will generally be found in low elevations and in the Oregon White Oak Plant Series north of the Rogue-Umpqua Divide, and at mid to low elevations south of the Rogue-Umpqua Divide in the Douglas-fir, Oregon White Oak, and White Fir Plant Series. In some areas, moisture stress related to high stocking levels is placing large numbers of important older pines at risk.

This treatment is particularly important in landscapes where pines provide important, possibly the only, large tree structure (e.g. Oregon White Oak Series). Although this treatment may be done is certain late-seral and old-growth stands, owl home ranges will generally be avoided.

Stand Criteria

Follow applicable portions of the 7/9/96 REO exemption criteria for commercial thinning. For prescribed fire, also use guidelines from the prescribed fire plan.

Follow the “Guidelines to Reduce Risks...” portion of the ROD standards and guidelines (ROD C-12,13). Clear around important dominant and predominant overstory pines where these trees are clearly at risk due to stocking levels (as evidenced at least in part by past mortality), the expected mortality would significantly reduce the functionality of the stand as habitat for late-successional forest related species in the short and long-term, and the mortality is not needed to contribute to a current snag deficit.

Remove competing vegetation, as needed, up to 24” diameter to the drip line plus 20 feet. In those situations where risk of mortality is caused predominantly by trees greater than 24” diameter, individual trees may be killed and left standing.

When not using prescribed fire, leave all snags and LWM, subject to operational safety concerns, unless precluded by criteria under “Reduce Fuel Loading in Stands Over 80 Years” elsewhere in this chapter.

This treatment may also be applied to complex mid-seral stands less than 80 years old where all other conditions above are met.

Treatment Amounts and Implementation Schedule

Table 48 provides an estimate of the maximum amount of candidate acres. For a variety of reasons, many of the estimated 115,500 acres will not be treated. Project level analysis is expected to show that some of these acres will not need additional treatment to maintain late seral characteristics. Some will be in spotted owl territories and be avoided. In addition, significant acres will be dropped from further consideration due to economics, road access, logging systems, non-treatment recommendations in riparian reserves, other standards and guidelines, and REO 7/9/96 criteria.

A conservative, closer estimate of actual treatment is approximately 10 percent of this, or 11,500 gross acres. This amount of treatment would result in a cleared area equivalent of 1,390 acres. These amounts are exempt from further REO review for a period of 5 years. Treatment proposals exceeding this rate remain subject to REO review.

For tracking purposes, these amounts are displayed by LSR administrative unit. If proposed treatments would exceed the amount listed by individual LSR administrative unit, coordination with other units in that LSR will be needed to assure that the amount listed as exempt from REO review is not exceeded for that LSR as a whole.

Table 48: Estimated Late Seral Stands with Ponderosa and Sugar Pine

LSR	Administrative Unit	Late Seral acres w/Pine	Approx. number of pine[44]	Maximum Treatment Acre Estimate[45]	Cleared Treatment Acres Exempt from REO review
North of Rogue-Umpqua Divide					
222	Eugene BLM	6,000	7,200	600	60
222	Willamette NF	18,800	22,600	1,800	180
222	Roseburg BLM	6,600	7,900	600	60
222	Umpqua NF	59,600	87,700	6,900	690
Totals		**91,000**	**125,400**	**9,900**	**990**
South of Rogue-Umpqua Divide					
222	Rogue River NF	4,600	5,600	400	40
224	Medford BLM	8,600	13,700	1,100	110
225	Rogue River NF	2,500	3,000	200	20
226	Rogue River NF	3,600	4,300	300	30
227	Rogue River NF	1,600	2,700	200	20
227	Winema NF	3,600	NE	1,800[46]	180
Totals		**24,500**	**29,300**	**4,000**	**400**

[44] Estimated at 1.2 pine/acre in TSHE and ABCO; 2 pine/acre in PSME and QUGA.
[45] Estimate based on 33' radius (13' crown plus 20' from drip line). Thus, 7200 pine @3420 sq. ft/tree equals 565 ac. of clearing, rounded to nearest hundred.
[46] Winema NF LSRA estimates treatment of about half the total acres.

TREATMENTS AND CRITERIA FOR SALVAGE

INTRODUCTION

This section includes criteria, which, if followed together with the Standards and Guidelines for Salvage found on pages C-13 through C-16 in the ROD, will result in an exemption, for a limited time and amount of treatment, from the necessity of REO review for salvage activities.

As such, these criteria allow only very conservative amounts of salvage. These criteria are not standards and guidelines, and projects meeting LSR salvage standards and guidelines, but not fitting these criteria, should continue to be forwarded to the REO for review.

BACKGROUND

Salvage inside LSRs was recognized as a contentious issue in Forest Ecosystem Management: An Ecological, Economic, and Social Assessment (FEMAT, July 1993). Three prescriptions were considered at that time, from no salvage to salvage with minimal guidelines. Prescription 2, limited salvage in LSRs, was carried forward and incorporated in the ROD.

The advantages were listed in FEMAT:
"Valuable trees that are dead can be used for commercial purposes with the attendant employment and economic benefits. These logs cannot be exported and so must be processed within the region. Increased fire danger or risk to insect and disease resulting from large accumulations of dead trees can be reduced in an economically feasible fashion.
Avoided are the perceptions of economic waste if patches of dead trees are not salvaged." (FEMAT, II-18).

The disadvantages were also described:
"There is potential risk to watersheds from roads and soil disturbance associated with salvage operations. If hypotheses about effects of management prove incorrect, salvaged areas may be adversely affected in terms of their short and long-term contributions to the achievement of Late-Successional Reserves. Certain segments of the public will be distrustful of agency motives whenever salvage is allowed inside a Reserve, particularly when such salvage occurs in portions of the Reserve that contain (or contained) trees considered to be true 'old growth' or 'ancient forest'." (FEMAT, II-18).

The ROD provides direction for salvage and states, "Salvage guidelines are intended to prevent negative effects on late-successional habitat, while permitting some commercial wood volume removal." (ROD C-13). The core team has not found a biological rationale for salvage. The following approaches and criteria for salvage are meant to minimize effects to late-successional species. The decision to salvage must be based on site-specific conditions, with the understanding that salvage operations should not diminish late-successional habitat suitability now or in the future. Standards and Guidelines for salvage are found on pages C-13 through C-16 in the ROD.

It is hoped that the following approaches, criteria, and process considerations will eliminate the need for each interdisciplinary team to reconsider the philosophical debate concerning whether salvage is generically appropriate in LSR allocation, and instead concentrate on if and where salvage helps meet Plan and LSR objectives for a given stand replacement event.

Two Approaches To Salvage

In this assessment, criteria for two conservative approaches to the salvage of dead wood are recommended:

- an Area Salvage Approach that suggests a landscape perspective to determine leave needs for large dead wood, and,
- a Fire Risk Reduction Approach through the use of fuel breaks after stand replacement events.

These are considered by the core team to be complementary approaches after large stand replacement events. They may be effectively used together in such a project. After small stand replacement events, they are considered to be alternative approaches. The use of both approaches on any one acre, conducted in subsequent years, could raise an issue of cumulative effects due to repeated entry.

Area Salvage Approach

The following are background, rationale, criteria, and examples for this approach.

Background

This LSR assessment shows that approximately 20 to 36 percent of the South Cascades LSR network currently supports early seral vegetation. Most of these acres are in plantations, which are generally low in down wood and snags because of management objectives and activities prior to the allocation to LSR. Increasing the dead wood in these managed early and mid-seral portions of the landscape will be accomplished primarily during density management thinning treatments in those stands needing such, and with the mortality process over time.

Where stand replacing events convert late seral stands to early seral stands, the issue of where and how much of the dead material to leave is presented.
Since the early seral portion of the landscape is generally low in dead wood, there is more early seral on the landscape than desired, and because the natural process following stand replacing events leaves much higher levels of dead wood than management practices have left in the past, the area salvage approach focuses on retaining most of the dead wood input following stand replacing events, while taking a landscape look to determine snag needs for a given site. Salvage decisions must also recognize the increased risk of reburn following stand replacing events, and that adjoining late seral stands likely have increased fuel levels because of fire exclusion over the past 60 years.

In the natural process, stand replacing fire events add large amounts of dead wood to the system (Spies, Franklin, and Thomas, 1988). A conservative approach to salvage needs to recognize the contribution of these peak events, and leave a substantial portion of that material in place to provide for habitat needs through early, mid-seral, and into late-seral stages. A review of the research on decay rates of snags and down wood suggests that much of the material 16 inches or greater in diameter would remain on a site (unless a subsequent reburn occurs) until the next forest stand could begin to input this size of material again.

Overview of the Area Salvage Approach

The ROD clearly indicates that “typical levels”, not all material, need to be left (ROD, C-15). It suggests salvage is appropriate to remove those levels, or concentrations, above typical. The problem then is to define typical levels for this LSR network. Although we do not know of numerous plots measuring added dead wood immediately following stand replacing events in these LSRs, we suggest that there are data available. The live tree data from ecology plots can be used to define “typical levels”, since this live biomass represents that material available to stand replacing events in the near future. Since fire exclusion has resulted in additional dead wood primarily in the smaller size classes, and because the smaller size classes are typically consumed in the stand-replacing portions of fire, we can use the larger diameter live tree data from ecology plots to represent “typical” levels of additional dead wood following stand replacing events (Table 49 and Table 50).

In this approach, median density within the high intensity (>10 acre, <40% canopy) portions of stand replacement events are compared to the median live trees/acre for the applicable plant series. Median density, and not the mean, is suggested to represent “typical” levels, due to the sometimes non-normal distribution across the unmanaged landscape.

Where density in the stand replacement area exceeds the live tree density of the plant series, a salvage opportunity generally exists, since the density exceeds the “typical” density of the plant series across the landscape.

The amount of dead wood removal is then defined by the difference between the density in the stand replacement area and the density of the “typical” levels of dead wood following stand replacement events, determined from the landscape plant series information. For example, if the density of the stand replacement area were 20% above that of the typical density, that amount could be removed, leaving the typical density after treatment. Since reducing snag density on each acre would be operationally hazardous, small patch clearcuts or group selection cuts are used, limited to 20% of the stand replacement area.

Likewise, where density in the stand replacement area is lower than the “typical” density of the plant series across the landscape, salvage is not generally indicated. However, since the decision to salvage is not determined solely by this “compare the numbers” procedure, but by additional landscape and site factors, exceptions to both cases are expected. Examples are provided.

Objectives

1. The purpose of these criteria are to provide an approach to salvage for the South Cascades

LSR network that is responsive to the ROD standards and guidelines; one that maintains most of the large amounts of dead wood that are contributed to the landscape following stand replacement events; and one that results in an exemption from further REO review for conservative amounts of salvage.

2. These criteria apply within the entire South Cascades LSR network. They may not always apply to a given project. It may be more appropriate to seek REO review at the time of project development where specific vegetation types, local issues, or objectives do not fit within these criteria, or where silvicultural prescriptions are needed other than as described below.
3. Exempted salvage must still comply with all pertinent S&Gs in the ROD and with other statutory and regulatory requirements (e.g. National Forest Management Act, Federal Land

Management Policy Act, National Environmental Policy Act, Endangered Species Act, Clean Water Act). Interagency cooperation, monitoring, and adaptive management are key components of the ROD and were key assumptions underlying the development of these criteria. Agencies having an interest in LSR projects proposed under these criteria should continue to be given the opportunity to participate in project development. Additionally, field units are strongly encouraged to engage in intergovernmental consultation when developing projects.

4. Creation or retention of habitat for early successional forest-related species is not a treatment objective.

Landscape Decision Process Criteria for Area Salvage

Summarize Candidate Stands

1. Determine the stand replacement (>10 acres and <40% canopy closure) area(s) of the event.

2. Sample to determine the median density of live trees and newly created dead wood in the replacement area(s) of the event, by plant series. Where the stand replacement event includes allocations other than LSR, sample the entire LSR portion of the stand replacement area.

Compare to Reference Conditions

3. To get an initial indication of salvage treatment opportunity, compare the median density in each Plant Series of the stand replacement area(s) to the median density of the “typical” levels, for each Plant Series in Table 49 or Table 50.

If the median density, by Plant Series in the potential treatment area is higher than the median of that Series from the table, then the initial indication is that a salvage opportunity exists. Likewise, if the density in the stand replacement area(s) is less dense than the median from the tables, it would suggest that salvage is not initially indicated for that Plant Series.

Consider Additional Factors

4. Regardless of what is initially determined in step 3, consider additional landscape and other site factors when deciding whether or not to salvage. Consider the location and concentrations of dead wood as it relates to slope position, aspect, fire history and risk, specific wildlife needs, adjoining allocations, access, logging systems and costs, reforestation and restoration opportunities, etc.

Decide about Salvage Treatment

5. Line officer makes a project decision after consideration of all the issues, consistent with all applicable standards and guidelines.

Treatment Standards for Area Salvage

1. Due to the safety concerns associated with operations within snag patches, use small patch clearcuts or group selection type harvests, rather than a partial harvest spread across the stand replacement area.

2. To enhance connectivity for certain small mammals and other species, keep treatment patch size small. For example, ten, five acre units are preferable to one, fifty acre unit.

3. Use the following table to determine the maximum salvage treatment area:

Where replacement area density is above reference density by this percentage,	Then remove no more than this percentage of the total stand replacement acres in LSR.
0-10%	10%
11%	11%
12%	12%
13%	13%
14%	14%
15%	15%
16%	16%
17%	17%
18%	18%
19%	19%
20% or greater	20%
Where replacement area density is below reference density by any percentage, then remove no more than 10% of the total stand replacement acres in LSR.	

4. Vary the size of material left in the stand replacement area (ie. do not remove only few acres of the largest diameter material, or large acres of the smallest diameter material). Keeping in mind the variability of natural stands, maintain variability within the stand replacement area. Maintain approximately 10 percent of the area in patches of the highest pre-treatment density, and 10 percent of the area in patches of the lowest pre-treatment density.

5. The retained wood should be in various sized patches in environments where it is most likely to persist, for example, in riparian areas, bottom thirds of slopes, and on north and east aspects.

6. Within the limits of acceptable fire risk, in areas capable of northern spotted owl habitat (ie. not
Lodgepole Pine Series), and where no dead wood biomass created by the stand replacement event is 16 inches dbh or greater, leave 13-15 percent cover in 4” diameter and larger dead wood to meet the habitat needs of the small mammal prey base. Leave mostly the larger diameter material, keeping in mind the objective (Carey, A.B., and M. L. Johnson, 1995). Retain existing piles, and/or pile some of the remaining down logs to enhance site conditions.

7. To the extent practicable, leave and protect from disturbance, all snags and LWM that were present prior to the stand replacement event.

8. Impacts to LWM decay classes III, IV, and V during salvage harvest will negatively effect habitat quality. These pieces still function as refuge habitat for some late successional species. Use yarding techniques to minimize disturbance to this LWM.

9. Reforestation using genetically selected trees may not always provide the greatest benefits to old-growth development and stand heterogeneity. Consider allowing natural seeding where seed sources are present.

10. Roads influence habitat fragmentation, can change the character of favorable disturbances, and provide corridors for spread of undesirable species. Road construction is not recommended with the exception of short, temporary native surface roads which can be obliterated within the same operating season. Where road construction is needed, these roads should be obliterated prior to the end of the project. Road construction within Riparian Reserves should follow watershed analysis recommendations and Riparian Reserve standards and guidelines.

Approach is Conservative

This approach is conservative in at least three ways:

- Use of the median as a reference will generally result in no more than half of the stand replacement areas being salvaged.
- Where densities exceed the reference median by more than 20%, the area of salvage is limited to a maximum of 20%. In the other case, where densities are lower than the median of the reference plant series, and other factors still lead the decision maker to salvage, these criteria limit the salvage to 10% of the stand replacement area.
- These criteria limit the REO exemption to five years, and to a cumulative, maximum salvage treatment area of 1% of LSR, by administrative unit.

Examples of Landscape Decision Process for Area Salvage

These examples are not meant to be exhaustive. They attempt to clarify the above process criteria, demonstrate the importance of the interdisciplinary process, clarify that salvage is a treatment decision of a line officer, and highlight the conservative nature of salvage treatments using these criteria. As indicated earlier, these criteria, (and examples) may not apply to all projects, therefore, projects consistent with ROD standards and guidelines, yet not following these criteria, should still be forwarded to REO for review.

Example 1.

Summary of Candidate Stands

A 35 acre fire, all in LSR, created 10 acres of stand replacement area. The stand replacement portion was within the ABCO plant series, in the southern portion of the LSR network. Eleven plots were taken to estimate live tree and newly created dead wood density within the 10 acre stand replacement portion. The median density was 19 per acre, in live trees and newly created snags or LWM. It ranged from 16-23.9” DBH.

Comparison to Reference Condition

Table 50 suggests the median for this DBH range, in the ABCO series, is 24 per acre. The initial indication is that since the candidate stand is under the reference density, no salvage be conducted.

Additional Considerations

The nearby vicinity and surrounding landscape (approximately 10,000 acres) contain a high percentage of previously managed early and mid-seral stands, which contain few snags and little down wood.

Salvage Treatment Conclusion
Salvage is not indicated.

Example 2.

Summary of Candidate Stands

A 50 acre fire, all in LSR, created 10 acres of stand replacement. The stand replacement portion is within the PSME plant series, in the northern portion of the LSR network. The summary of eleven plots within the stand replacement portion showed a median density of 50 snags and live trees/acre, ranging from 20-36 inches DBH.

Comparison to Reference Condition

Table 49 suggests the median density for this DBH range is 38 per acre. Since the candidate stand is 32% more dense than the reference condition, the initial indication is that a salvage opportunity exists that might remove up to 20% of the area, or 2 acres.

Additional Considerations

The nearby vicinity was mostly late seral, which contained snags and LWM consistent with late seral stands.

Salvage Treatment Conclusion
Using these criteria, salvage of up to 2 acres is a treatment opportunity.

Example 3.

Summary of Candidate Stands

A 5,000 acre fire created 1,000 acres of stand replacement, with 600 acres of that in a

Wilderness Area, and 400 acres in LSR. The stand replacement portion was in the northern portion of the LSR network, and included two different plant series, 700 acres in ABCO and 300 acres in PSME.

Thirty plots were taken within the LSR in each plant series. The median density was 42 per acre in ABCO, and 45 per acre in PSME, in stems 16” DBH and greater. The DBH range in both series was from 16”-24” and greater.

Comparison to Reference Condition

Table 49 suggests the median reference density for the ABCO series with diameters greater than 16” is 52 per acre. The candidate stands are 20% less dense than the reference, therefore the initial indication is for no salvage in the ABCO portion.

Table 49 suggests the median reference density for the PSME series with diameters greater than 16” is 49 per acre. The candidate stands are 8% less dense than the reference, therefore the initial indication is for no salvage in the PSME portion.

Additional Considerations

Within the Wilderness, the fire has created significant new inputs of dead wood that will not be salvaged.

Within the LSR, the ABCO potential salvage areas are not in the vicinity of spotted owl nests, have access such that additional road construction would not be required, and includes portions of higher density than the overall median.

Within the LSR, the PSME potential salvage areas are on upper slopes in the high Cascades lightning zone, and require only temporary road construction for access.

Salvage Treatment Conclusion

Since the fire has created significant new inputs of dead wood in Wilderness that will not be salvaged, the decision maker may conclude that salvage is an opportunity, limited to 10% of the ABCO area in LSR. Likewise in the PSME area, the decision maker may conclude that salvage is an appropriate treatment, limited to 10% of the PSME area in LSR.

On the other hand, since the risk of reburn may remain high in the adjacent Wilderness, and reburn may result in significant reduction to the newly created dead wood, the decision maker may conclude that salvage in the LSR is not an appropriate treatment.

Example 4.

Summary of Candidate Stands

A 5,000 acre fire created 1,000 acres of stand replacement, with 600 acres of that in a Matrix allocation, and 400 acres in LSR. The stand replacement portion was in the northern portion of the LSR network, and included two different plant series, 700 acres in ABCO and 300 acres in PSME.

Thirty plots were taken within the LSR in each plant series. The median density of trees and newly created dead wood was 62 per acre in ABCO, and 59 per acre in PSME, in stems 16” DBH and greater. The DBH range in both series was from 16”-24” and greater.

Comparison to Reference Condition

Table 49 suggests the median reference density for the ABCO series with diameters greater than 16” is 52 per acre. The candidate stands are 19% more dense than the reference, therefore the initial indication is to salvage in the ABCO portion.

Table 49 suggests the median reference density for the PSME series with diameters greater than 16” is 49 per acre. The candidate stands are 20% more dense than the reference, therefore the initial indication is that a salvage opportunity exists in the PSME portion.

Additional Considerations

Within the Matrix, the fire has created significant new inputs of dead wood that are likely to be salvaged.

Within the LSR, the ABCO potential salvage areas are near spotted owl nests, in riparian areas or on the lower third of slopes where lightning fire starts are less frequent, and would require additional road construction.

Within the LSR, the PSME potential salvage areas are on mid-slopes on northerly aspects.

Salvage Treatment Conclusion

Since the fire has created significant new inputs of dead wood in Matrix, where significant amounts of salvage are expected, the decision maker may conclude that salvage within the

LSR is not a prudent treatment.

Example 5.

Summary of Candidate Stands

A 150 acre fire, all in LSR, created 100 acres of stand replacement area. The stand replacement area is within the ABCO plant series, in the southern portion of the LSR network.

Fifteen plots were taken to estimate live tree and newly created dead wood density in the 100 acre replacement area. The median density was 27 per acre, all in standing snags. The diameters were all 24 inches DBH, or larger.

Comparison to Reference Condition

Table 50 suggests the median reference density for the ABCO series, southern portion, greater than 24” DBH, is 28 per acre. The initial indication is that since the candidate stand is below the reference density, salvage is not indicated.

Additional Considerations

The stand replacement area is on the upper third of south-facing slopes. The snags have interlacing, dead crowns. It is in the high Cascades lightning zone. The surrounding landscape is largely composed of late seral stands.

Salvage Treatment Conclusion

Even though the density is below the reference condition, the decision maker decides that the risk of reburn is high enough that an area salvage worth considering, limited to 10% of the area, or 10 acres. In addition, the project team considers the addition of fuel breaks within the stand replacement area.

Example 6.

Summary of Candidate Stands

A 75 acre fire, all in LSR, created 25 acres of stand replacement area. This portion was all within the TSHE series, in the northern portion of the LSR network. Eleven plots were taken to estimate the live tree and newly created dead wood density within the 25 acre replacement area. The median density was 76 snags per acre, all larger than 22 inches DBH.

Comparison to Reference Condition

Table 49 suggests the median for this DBH range, in the TSHE series, is 38 snags per acre larger than 22 inches DBH. Since the candidate stand is twice as dense as the reference level, the initial indication is that a salvage opportunity exists, to remove a maximum of 20% of the area, or 5 acres.

Additional Considerations

The candidate stand is near significant amounts of industrial forest land, mostly early seral, without much large wood. The area is not known for high fire starts, and there is not a rural interface fire issue. There are cooperative restoration opportunities that might be partially funded with timber sale proceeds. Spotted owl sites exist in the adjacent, unburned stand.

Salvage Treatment Conclusion

Even though the numbers suggest that a salvage opportunity is warranted, the line officer might conclude that “keeping the pieces” suggests no treatment in this situation.

Table 50: "Typical Levels" of Density In Stand Replacing Areas of Stand Replacement Events, by Plant Series, Southern Portion of LSRA Network (Cascades portion, Rogue River NF Data)

Plant Series	Live and Dead Wood Per Acre by DBH Class.			
	16-19.9"	20-23.9"	24"+	# of plots
Shasta Red Fir, ABMAS				9
median	**9**	**4**	**23**	
mean	13	8	21	
range	0-20	0-29	0-52	
Mountain Hemlock, TSME				17
median	**14**	**14**	**33**	
mean	14	16	31	
range	0-37	0-47	0-60	
White Fir, ABCO				92
median	**13**	**11**	**28**	
mean	16	12	29	
range	0-70	0-47	0-72	
Douglas-fir, PSME				13
median	**7**	**6**	**16**	
mean	19	9	12	
range	0-80	0-37	0-23	
Western Hemlock, TSHE				22
median	**12**	**10**	**32**	
mean	13	12	29	
range	0-43	0-46	0-48	
Oregon White Oak, QUGA[49]				
median	**7**	**6**	**16**	
mean	19	9	12	
range	0-80	0-37	0-23	
Lodgepole Pine, PICO[50]				
median	**14**	**4**	**4**	
Ponderosa Pine, PIPO[51]				
median	**7**	**6**	**16**	
mean	19	9	12	
range	0-80	0-37	0-23	

[49] Data were too limited for this Plant Series. This Series is most closely represented by the Douglas-fir Series, therefore those numbers are used in this table.
[50] Data were too limited for this Plant Series. Numbers were estimated to reflect the expected values for this Series. For the eastern portion of LSR 227, use guidelines from the Winema NF LSR Assessment.
[51] Data were too limited for this Plant Series. This Series is most closely represented by the Douglas-fir Series, therefore those numbers are used in this table. For the eastern portion of LSR 227, use guidelines from the Winema NF LSR Assessment.

Fuel Break Salvage Approach

This approach focuses on reducing the increased fire risk associated with the large amounts of dry, dead fuels present after stand replacement events. It is intended to be used in addition to the fuel break network suggested in the section, “Treatments and Criteria to Reduce Risk of Large Scale Fire”. The objective is to reduce the continuous area of high risk fuels by strategic placement of fuel breaks within the high intensity (stand replacement) portions of large fires. It may be used to help mitigate the increased long term fire risk associated with leaving the large amounts of snags associated with the area salvage approach. TABLE 53 summarizes the treatment and criteria. The criteria are those listed on page 151, “Reduce Large Fire Risk with Fuel Breaks.” Figure 21 presents an example.

Figure 21: Fuel Breaks After Stand Replacement Fire

POTENTIAL SALVAGE TREATMENT AREAS (1996)

The Umpqua, Willamette, and Rogue River National Forest portions of the South Cascades LSR network experienced lightning-caused fires in 1996 (Table 51 and Figure 11). These are the current potential salvage areas within the South Cascades LSRs.

While project planning and NEPA decisions will determine specific treatment needs, the most acres that could be treated can be estimated here. Of the 6000 acres in 17 fires during 1996, a maximum of about 1077 acres in 5 fires qualify for salvage consideration under the standards and guidelines in the ROD.

Table 51: 1996 Fires in South Cascades LSR Network Larger than 10 Acres. Only Acres within LSR are Shown

LSR	Admin. Unit	Fire Name	Fire Acres in LSR	Stand Replacement Acres in LSR
222	Umpqua NF	Baby Wren	5	0
222	Umpqua NF	Bearbones 1 & 2	293	110
222	Umpqua NF	Black Gorge	280	40
222	Umpqua NF	Bohemia Bubble	24	0
222	Umpqua NF	Firemans Leap	23	0
222	Umpqua NF	Horse Prairie	57	10
222	Umpqua NF	Johnson Creek	7	0
222	Umpqua NF	O Four	7	0
222	Umpqua NF	Quarry	56	5
222	Umpqua NF	Rumble	27	0
222	Umpqua NF	Smurf	42	5
222	Umpqua NF	Spring	4988	890
222	Umpqua NF	Tabasco	4	0
222	Umpqua NF	Three Springs	15	0
222	Umpqua NF	Washboard	37	2
222	Umpqua NF	Wren	95	5
222	Willamette NF	Bearbones 1 & 2	15	0
222	Willamette NF	Bohemia Bubble	12	0
227	Rogue River NF	Hepsie Fire	42	10
TOTAL			**6029**	**1077**

Treatment Amounts And Implementation Schedule

The extent of stand replacement events within the next few years cannot be predicted, however, exemption from further REO review for a reasonable, yet conservative amount of salvage treatment is requested.

Exemption is requested for all salvage treatments combined, to not exceed approximately one percent (7,100 acres) over 5 years. This amount is expected to be enough for most situations, but would require review for very large stand replacement events. For tracking purposes, this amount is segregated by LSR administrative unit. If proposed treatments would exceed the amount listed by individual LSR administrative unit, coordination with other units in that LSR will be needed to assure that the amount listed as exempt from REO review is not exceeded for that LSR as a whole.

Table 52: Cumulative Salvage Treatment Area Exempt from Further REO Review

LSR	LSR Total Acres	Salvage Treatment Area Exempt from Further REO Review (@ Approx. 1% of total acres)
222, Eugene BLM	21,200	200
222, Roseburg BLM	25,500	250
222, Umpqua NF	342,800	3,400
222, Willamette NF	93,300	900
222, Rogue River NF	25,200	250
224, Medford BLM	21,500	200
225, Rogue River NF	39,800	400
226, Rogue River NF	49,800	500
227, Rogue River NF	52,800	500
227, Winema NF	48,800	500
Total	**720,700**	**7,100**

TREATMENTS AND CRITERIA FOR MULTIPLE USE ACTIVITIES OTHER THAN SILVICULTURE

Non-silvicultural activities are on-going and new ones may be proposed within the LSR boundaries. “As a general guideline, nonsilvicultural activities located inside Late Successional Reserves that are neutral or beneficial to the creation and maintenance of late-successional habitat are allowed.” (ROD C-16). Although non-silvicultural activities do not require REO review, projects must be consistent with the ROD. The ROD provides good direction on these types of activities (C-16 through C-19).

During the period from December 1996 through January 1997, visits were made to individual land management units to collect details on existing land uses and additional items of note. See Table 6 for the summary of “Multiple Use Activities Other Than Silviculture”. At that time, none of the current uses were judged to have adverse effects on LSR objectives.

There may, however, be some site-specific areas that are outside of ACS or LSR objectives. These will need to be reviewed at a finer scale, either in watershed analyses or environmental assessments.

ROAD CONSTRUCTION AND MAINTENANCE

Substantial road related restoration is needed in LSR 222 due to increased slides the past two winters. Deferring road maintenance may have adverse effects on LSR objectives as impaired drainage increases the potential of roadbed slumps and increased sediment delivery to streams. When deferred maintenance keeps roads closed, this will affect the ability to respond rapidly to fire, increasing the chance of large scale fire.

Access and Travel Management Plans are also needed.

Improvements are planned by Fed. Highway Administration on the Elk Cr. Road in LSR 224. This project does have some impact on the riparian area.

During road upgrades and maintenance, consider the following:

- Facilitate the upstream/downstream movements of species with culvert size and placement (or other stream crossing structures) decisions.
- Increase the frequency of drainage dips or culverts to reduce changes in drainage patterns.
- Stockpile down wood from hazard removal sites and place in areas near wetlands, ponds, and lakes where past management has reduced dead and down wood.
- Modification or removal of culverts and water diversion structures where possible to restore aquatic connectivity.

ROAD DECOMMISSIONING

The objectives of road decommissioning include:

- reducing the length of the road-related drainage network;
- improving habitat connectivity for amphibian and other species;
- restoring riparian and aquatic conditions;
- increasing terrestrial late seral patch size; and,
- reducing sediment delivery from roads and upslope areas.

These objectives are derived from ACS riparian and fisheries goals.

In addition to the objectives, there are other considerations when planning road systems and road decommissioning. Access to non-federal land needs to be considered. In addition, access may be needed for fire suppression, outdoor recreation, restoration projects, other LSR projects, or projects in other land allocations.

Nevertheless, there are opportunities to reduce the amount of existing roads within the South Cascades LSR network. Priority consideration for decommissioning and improvements in existing roads should be given to:

1. Roads within riparian reserves in key watersheds; particularly where roads have major influences on ground water, drainage patterns, flows and sedimentation on wetland, pond, spring, and seep habitats.
2. Roads within riparian reserves not in key watersheds; but where roads are within 600 feet of ponds, wetlands, springs, seeps and lakes, especially upslope of wet areas and where roads bisect a system of wetlands, ponds, or where roads exist between streams, wetlands, or ponds.
3. Roads outside of riparian reserves in key watersheds.
4. Roads within watersheds that have road density below 3 miles/square mile. The rationale is to improve or reinforce areas that are considered close to “fully functioning” based on road density.
5. Roads where density in the transient snow zone is greater than 3 miles per square mile; and,
6. Roads where density in the nontransient snow zone is greater than 3 miles per square mile.

Developments

Pelican Butte Ski Area, LSR 227

There is a proposed ski area at Pelican Butte on the Winema National Forest. Most of the facility would be outside of LSR 227, but access and potentially some development may be proposed within the LSR. The implications will be addressed with REO separately from this assessment.

Westfir Administrative Site, LSR 222

The reconstruction of the Westfir Administrative Site will require an additional 1/2 to 1 acre clearing for expansion of the parking lot.

Range Management

Tiller Ranger District on the Umpqua National Forest has an environment assessment in progress. Some potential conflicts with LSR objectives due to traditional use areas, riparian concerns, and introduction of nonnative species.

Generally, livestock grazing is incompatible with desired vegetative conditions in wet areas. Consider excluding livestock from wet areas and their associated riparian reserves. Restore vegetative condition through planting if natural reproduction is unlikely. Maintaining or restoring riparian and forest vegetative structure including height, canopy cover, and vigorous

reproduction in herb, shrub, hardwood and conifer tree layers, is desired to meet LSR and ACS objectives.

Rights-of-Way, Contracted Rights, Easements, Special Use Permits

A proposed flood control dam on Elk Creek is half-build, but the project is currently on hold due to fish blockage issue. Other special use permits are inconsequential.

Nonnative Species

Roads have provided pathways for nonnative and noxious weed introductions and spread within the LSRs. See Table 6 and the Existing Conditions section “Nonnative Species” for additional information.
Plans for addressing negative impacts on native species in wet areas need to be developed (ROD C-19). Several of the following recommendations are outside the direct authority of the federal land management agencies. Work cooperatively with the State of Oregon when considering the following restoration items:

- Reduce water levels in ponds and wetlands to depths unsuitable for fish and bull frogs.
- Eliminate fish stocking in lakes determined to be important in habitat value or spatial connectivity.
- Control bull frog populations through removal of adults and egg masses.
- Reduce the potential for disease, parasite and nonnative species spread with the use of clean equipment policies (e.g. for multiple drafting set up portable tanks with one clean draft line to water).

Fuelwood, American Indian Uses, Mining, Land Exchanges, Habitat Improvement Projects, Special Forest Products, Recreation Uses, And Research

None of these current uses have adverse effects on LSR objectives. There may be some sitespecific areas that are outside of ACS or LSR objectives. Some will need to be reviewed at a finer scale either in watershed analyses or project environmental assessments. Firewood harvest and mushroom permits, in particular, should continue to be examined for consistency with standards and guidelines and LSR objectives. Generally, though, most sites occupy such a small area that, overall, the ecological functions the LSRs will not be disrupted.

Appendix C
Management Recommendations from the Elk Creek Watershed Analysis

IV. MANAGEMENT RECOMMENDATIONS

A. INTRODUCTION

The purpose of this Chapter is to summarize the findings from previous Chapters and provide management recommendations to Federal land managers for public lands. The following recommendations include general analytical recommendations as well as recommendations that are responsive to the Issues and Key Questions from Chapter III. Throughout the discussions, needs for restoration have been incorporated. Section D. summarizes monitoring needs and Section E. provides an integrated set of management options based on landscape types and features.

B. GENERAL ANALYTICAL RECOMMENDATIONS

This Section captures recommendations that are primarily applicable to any subsequent analysis within the Elk Creek Watershed. These could include the next version of Watershed Analysis, either on the watershed or subwatershed scale, the next version of Late-Successional Reserve Assessment (watershed or Reserve specific) and/or any further analysis done for specific projects. In many ways, these recommendations would assist in filling data gaps uncovered during this process.

- Future landscape assessment and/or project analysis should include field verification of stream classes, location and morphology, their order of importance related to need and restoration opportunities within the watershed, and their status related to providing for beneficial uses.
- Subsequent planning and analysis should continue to validate reforestation access needs, public access needs and access needs for fire management.
- Comprehensive (cumulative effects) analysis to evaluate the hydrologic condition of the watershed should be done at the subwatershed scale.
- Data that evaluates owl demographics should continue to be collected.
- Data should be collected to determine and prescribe the amount and distribution of large coarse woody debris and snag densities.
- When closing Level 1 roads, review on a case-by-case basis the need for and effects of removing existing culverts.
- Update all Allotment Management Plans to assess the implications of the Northwest Forest Plan on the grazing program.
- Survey stream reaches every ten years or after 25 year flood events to determine changes and trends in aquatic habitat.
- Forest Service administered sections 1 & 11, and portions of sections 3, 13 & 15 in the Morine Creek area, (T.33S., R.1W., Jackson County), are recommended for re-allocation to LSR, where National Forest Land is contiguous with the LSR designation on BLM administered land. This may require an analysis and decision under NEPA.
- Complete Watershed Improvement Needs (WIN) inventory work to identify restoration needs related to existing roads.
- Resolve mapping discrepancies between Forest Service and Bureau of Land Management associated with big game winter range habitat.
- Work toward integrating Forest Service and Bureau of Land Management geographic information databases.

C. ACTIONS TO ADDRESS ISSUES

The format for this section borrows from Chapter III by summarizing the Issues and the Findings for the Elk Creek Watershed, the implications of these findings, the underlying objective(s), and statements or listings of recommended management actions.

1. <u>Anadromous Fish Habitat - Hydrology</u>

<u>Findings:</u> Human activities and artifacts, such as the presence of roadways within floodplains, have tended to create straightened channels which provide little resistance to water movement. The cumulative effects associated with past human activities have resulted in a limited amount of high quality, well-distributed salmonid habitat and is likely to have reduced overall survival rates of cutthroat and steelhead trout. The result has been an overall increase in the velocity and quantity of water flows during and shortly after storm events, which:

- periodically have dislodged debris jams,
- caused channels to down-cut and become confined (some streams can no longer reach the original floodplain even during flood events),
- increased the quantity, size and distance suspended particles are being transported, and
- increased the severity of streambank erosion and associated amounts of soil deposition.

In addition, alterations and removal of riparian vegetation, particularly the harvest of overstory conifer trees, as well as activities associated with road building, grazing and rural developments have:

- caused a reduction in the amount and distribution of streamside shade and large woody debris,
- reduced bank stability, and
- modified the morphology of many channels.

The way in which water is being captured, stored and released has been altered as a result of cumulative past human activities, primarily related to road building, timber harvesting, ranching and rural development. The result has been:

- an increase in stream temperatures, (five streams are considered to be "water quality limited" by the DEQ under the Federal Clean Water Act) including: Bitter Lick, Sugarpine, West Branch Elk Creek, Hawk (from the Mouth to the Headwaters) and Elk Creek (from the Mouth to Bitter Lick),
- occasional peaks in turbidity above natural rates, and
- increased rates and quantities of runoff and soil transport during and shortly after storm events, applicable to areas where runoff cannot infiltrate and becomes concentrated, primarily associated with impermeable road surfaces.

<u>Recommendations</u>: Restore anadromous fish habitat to increase survival rates by improving the abundance and quality of spawning gravels, deep pool habitat, side channels, overwintering habitat (channel structures and log jams which can shelter fish), while maintaining water temperatures and quality that can sustain multiple fish species within the Elk Creek Watershed.

The following specific recommendations would allow progress toward these objectives:

- encourage the development of late-successional riparian vegetation which would be typical and expected within the Elk Creek Watershed, especially where overhanging cover and root structure is lacking or where streambanks are eroding,
- reduce surface erosion and channeling of runoff within floodplains by reducing or eliminating known, identified sediment sources,
- encourage water conservation to increase summer base flows,
- provide shelter/cover for juvenile salmonids in pools by creating debris structures,
- protect fingerlings from traveling into water diversion channels by placing screens at diversion sites,
- slow down high water flow rates where feasible by placing large logs within channels, by creating side channels, and

encouraging beaver colonization,

- restore slope-bound and alluvial valley stream segments to include low stream gradients with a high width-to-depth ratio and meandering side channels where feasible,
- encourage cooperative/voluntary participation of landowners, groups and agencies when planning and implementing watershed restoration projects within the floodplain of Elk Creek,
- protect known beaver habitat,
- remove obstructions to allow for fish migration for multiple fish species and life stages throughout the entire mainstem of Elk Creek by eliminating passage problems at all known human-created passage barriers,
- implement stream-specific recommendations for fisheries contained in the Aquatic Ecosystem Report, Appendix K, and Forest Service 1990 stream survey report (available at the Prospect Ranger District),
- import and place large wood in stream channels where amounts are considered deficit, taking into consideration landform, stream gradient, and floodplain width,
- encourage the development of conifer dominated late-successional Riparian Reserves, especially in West Branch Elk Creek (BLM),
- enhance or develop side channels/riparian areas, especially along West Branch Elk Creek, Sugarpine Creek, Flat Creek, Bitter Lick Creek and on the maintstem of Elk Creek, where feasible, and

Allow for the recovery of hydrologic conditions by:

- maintaining Riparian Reserve widths as recommended by the Northwest Forest Plan. Conduct specific analysis that determines conditions to attain Aquatic Conservation Strategy objectives, and
- coordinate with private land owners to encourage restoration on non-Federal lands.

2. Fire Risk - Reintroduction of Fire

Findings: This watershed has missed 2-3 natural fire cycles which has resulted in a moderate to high fire hazard (based on vegetative and climatic conditions, related to topography). Records of human and natural fire starts, which average 14.5 starts per year, combined with known evidence of fire such as charred stumps, logs and snags, suggest that fire events will occur. However, when, where, at what intensity and to what extent is difficult to predict. The implementation of the Northwest Forest Plan will generally result in further increases in vegetative densities, increased amounts of ground fuels (depending on future management activities), and most likely, slower access for fire suppression vehicles caused by reduced road maintenance and road decommissioning.

The safe re-introduction of fire within the Elk Creek Watershed would be complicated by:

- the exclusion of fire in most of the watershed which has resulted in large, continuous areas being characterized by moderate to heavy down fuels and densely growing, multi-layered vegetation, (increasing the difficulty and cost of containing controlled burns),
- the “checker board” ownership pattern in the southern half of the watershed,
- the presence of steep, rugged terrain which tends to favor preheating and drying of vegetation ahead of the fire front increasing risk of escape, limits feasible options for control methods, increases implementation costs, and poses logistical challenges for providing safe holding and fire line sites,
- limited vehicle access (primarily associated with the Bitter Lick Roadless Area),
- various vegetative types, some of which are highly flammable,

- limited funding and personnel, and

- restrictions placed on controlled burning associated with the Rogue River National Forest Smoke Management Plan, Oregon Smoke Management regulations and the Clean Air Act for air quality.

Recommendations: Protect values and resources associated with Late-Successional Reserves, the Tier 1 Key Watershed, public and private facilities and human life by:

- introducing controlled fire where fire risk and hazards are moderate to high and where protection of resources is most critical,

- applying fire in such a way as to maintain duff and litter by burning at a low to moderate intensity in a mosaic type pattern, which may include several repeated treatments. Recommend initiating fire hazard reduction activities in Fuel Models 8 & 10 (closed-canopy white fir and white oak), and

- by applying commercial thinning, precommercial thinning and pruning as methods to separate tree crowns and continuous fuels, along with treating slash (3 inches diameter plus). Slash treatments should occur soon after thinning activities are completed.

3. Late-Successional Conditions

Findings: The watershed is composed of 18.2 % late-successional forests, with 14,079 acres being located on public lands. Most late-successional forests tend to be located in irregularly-shaped patches scattered throughout the mid to upper elevations. Of the late-successional vegetation type on public lands, approximately 90% lies within the Late-Successional Reserve allocation.

An estimated 27,800 acres, or 32%, is currently providing suitable habitat for the northern spotted owl on Federally administered lands. While it is not known what type of vegetative patterns and composition should exist in the designated Late-Successional Reserves to ensure the viability of 20 owl pairs (one of the goals of the LSR), it is recommended that the short-term objective (10 years) should be to maximize the extent of late-successional habitat. Although fifty-four historic owl sites were identified within the watershed, in the last decade, populations have declined.

Recommendations: Increase the amount and size of late-successional forest patches and vegetative conditions by:

- managing stands to develop multi-aged and multi-layered characteristics through thinning and uneven-aged management,

- maintaining oak woodlands,

- maintaining ponderosa and sugar pine components where historical or present occurrence is evident; apply density management around existing (large) ponderosa and sugar pines (BLM and FS) to maintain those components,

- experimenting with various silvicultural treatments in representative types to see how vegetation responds,

- on BLM lands, brushing and precommercial thinning stands in early-successional conditions to accelerate the development of late-successional characteristics (fire recommends accomplishing as early as possible to reduce fuels buildup). Of note are the Flat Creek, W. Branch Elk Creek, Timber Creek and the Burnt Peak Fire Area, and

- on FS administered land, considering opportunities for density management in “off-site” pine stands. Lack of species diversity, especially for sugar pine, may be a concern and an opportunity in the upper portions of the watershed.

4. Public Access

Findings: Federally appropriated road maintenance dollars and funding generated by commercial timber revenues have decreased drastically since the early 1980’s, resulting in an inability to maintain Federally-administered roadways to current management standards. The result has been:

- maintenance Level 1 roads, which would normally be barricaded after activity use is completed, are accessible to vehicle traffic,
- some roadway signs have deteriorated,
- the need to seasonally close roads without the funding or people required to enforce restrictions,
- unregulated off-road vehicle use,
- sediment production related to rapid runoff and channeling of water along roadways, and
- the presence of hazard trees in proximity to roads that can threaten human safety for forest users.

Road densities by sub-watershed range from 2.24 to 7.29 miles per square mile. An estimated 57% of the watershed contains greater than 6 miles per square mile. The result of moderate to high road densities has been:

- increased water discharge rates, peak flow quantities, and turbidity,
- straightening of stream channels, reduction in the number of side channels and increased deposition, and
- increased disturbance and poaching of blacktail deer and elk.

Recommendations: Reduce the number of road miles accessible to vehicle use and associated maintenance costs on Federally-administered Maintenance Levels 1 and 2 roads by:

- decommissioning Maintenance Level 1 roads not needed for timber stand improvement, fire suppression access, or commercial activities (eventually ALL Level 1 roads should be considered for decommissioning within designated LSR's).
- applying and enforcing seasonal use restrictions,
- reducing maintenance level objectives or standards, where appropriate,
- designing future projects (such as timber sales) so that they permit or generate funding to accomplish or assist with road closing, constructing barricades, and road decommissioning.

Reduce road-related soil transport, particularly within or in proximity to stream channels and floodplains by:

- repairing fillslopes, travelways, cutslopes, ditches and culverts where down-cutting, surface rutting, puddling, and other signs of erosion are occurring,
- limiting vehicular traffic during periods of wet weather on unsurfaced roadways, and
- relocating the Bitter Lick and Sugarpine Trailheads (see discussion in Roads Recommendations section).

a) Specific Road Recommendations

National Forest: The following table displays recommendations for changing the way in which Forest Service administered roads should be managed. Access and Travel Management objectives were considered for various Forest Management activities including public, recreational, timber, timber stand improvement, fire and other special interests in relation to current Road Management Objectives (as of May 1996). Recommended changes to forest system roads and their status are described in the table below.

Table 14. Specific Road Recommendations for National Forest.

Recommended Action	Road Number	Current Maintenance Level	Length in Mile(s)	Section Of Road
Decommission	6610210	1	0.10	6610 to end
	6610550	1	0.11	6610 to end
	6610556	1	0.10	6610 to end
	6610635	1	0.57	Fawn C. P. to 6610
	6610816	1	0.15	6610810 to end
	6610817	1	0.10	6610810 to end
	6610842	1	0.14	6610800 to end
	6620300	1	0.20	6620 to end
	6620589	1	0.18	6620 to end
	6620593	1	0.09	6620590 to end
	6620610	1	0.10	6620 to end
	6620860	1	0.07	6620 to end
	6620890	1	0.10	6620 to end
	6640109	1	0.09	6640107 to end
	6640150	1	0.40	6640 to F.S. boundaries
	6640200	1	0.27	6640 to end
	6640245	1	0.20	6640250 to end
	6640320	2	0.30	6640 to end
	6640400	1	0.20	6640 to end
	6640450	1	0.10	6640 to 6640250
	6640505	1	0.20	6640500 to end
	6640562	1	0.03	6640560 to end
	6640815	1	0.40	6640810 to end
	6640830	1	0.15	6640 to end
	66028	1	0.13	6600020 to end
	66280	1	0.21	66 to end
	6600350	2	0.03	6600300 to end
	6600375	1	0.10	6600300 to end
	6600379	1	0.10	6600300 to end
	6600390	1	0.20	66 to end
	6600425	1	0.10	66 to end
	6600435	2	0.18	6600430 to end
	6470690	1	0.30	6470 to end
	6470720	1	0.20	6470 to end
	6470750	1	0.10	6470 to end
	6470780	1	0.40	6470 to end
	6470785	1	0.10	6470 to end
	6470790	1	0.10	6470 to end
	6470793	1	0.15	6470 to end
Change to Maintenance Level 2	6610	3	6.82	BLM road to end (1.52 Elk WA. Bdry.)
	6610600	3	4.29	6610 to 6620
	66300	3	3.93	66 to 6470
	6470	3	3.40	Boundary to 6640
Relocate the Bitter Lick Trailhead so that it could be accessed from road 6620 (would allow for the possible decommission of road 6620050). Coordinate with recreation.	6620050	2	0.28	6620 to private (last 0.4 mile is on private land).

Relocate the Sugarpine Trailhead so that it could be accessed from road 6610 (would allow for the possible decommission of road 6610050). Coordinate with recreation.	6610050	2	0.28	6610 to end
Change to Maintenance Level 1 and close/barricade	6620515	2	0.42	6620500 to end

Bureau of Land Management administered roads: The process for assigning Road Management Objectives has not been completed as of July 1996 for Bureau of Land Management administered roads. Future road review processes should consider opportunities to reduce road densities, especially when located on sidehills, lowland areas, or in big game winter range. In addition, the following criteria should be considered when determining future road decommissioning opportunities and priorities:

- roads less than 0.5 miles in length,
- roads that include multiple stream channel crossings,
- roads in proximity to Riparian Reserves and stream channels,
- natural surfaced roads (versus surfaced), and
- roads located on geologically unstable terrain, or where constructed on soils with a high potential for erosion.

5. Grazing

Findings: Livestock grazing is not a major human enterprise within the Elk Creek Watershed, and some of those who have permits with the Federal government, do so as a secondary source of income. The current costs and revenues associated with the grazing program for the Federal government are expected to continue into the future. Major resource effects resulting from livestock grazing and associated human practices such as diverting water for irrigation, development of pasture land, and road use include:

- the spread of non-native plant species,
- alteration of stream-side vegetation and channels (causing increases in stream temperatures and sedimentation), and
- reduction of summer base flows in streams.

Preliminary utilization/distribution inventories indicate that some areas are being underutilized by cattle, while other areas are being over utilized. Typically where water is available, utilization of forage is good. Where water is absent, utilization tends to be poor.

Recommendations: Regulate grazing practices to allow for good utilization of forage by:

- developing water sources to modify utilization patterns, in areas with poor utilization,
- increasing plant production by seeding with native, palatable plant species,
- decreasing the length of use, and controlling animal movement in underutilized areas,
- using grazing as a tool to control brush, prepare seed beds for planting, and as a way to obtain income from forested lands, and
- seeding along some roadsides and in strategic locations to increase available forage.

Criteria to consider as part of managing forest-range program within those allotments in Elk Creek Watershed should include:

- physical and biological feasibility and consequences,
- economic feasibility,
- social acceptability, and
- operational practicality.

6. **Timber Harvesting - Economics**

Findings: While timber harvesting activities have significantly declined in the last five years, expenditures related to designing, implementing and administering timber sales have increased. The result has been:

- a reduction in timber sale receipts which supported road maintenance, timber stand improvement activities such as precommercial thinning and reforestation, and other restoration or enhancement projects,
- decline in the amount of commercial timber volume supplied to local wood processing companies,
- decline in available public use firewood cutting areas,
- an overall trend of increased logging system costs, and
- limited opportunities for small logging enterprises.

Recommendations: Use timber harvesting/logging as a tool to manage vegetation to meet Matrix, Late-Successional Reserve, and Riparian Reserve land allocation objectives. Implementation should include:

- prioritizing efforts to encourage the development of new markets and products to maximize the value of small diameter material, and
- considerations for applying various silvicultural prescriptions which address multiple resource objectives (refer to Table 15.).

D. MONITORING

Ongoing monitoring efforts within the watershed should include:

- Monitor trends in juvenile salmonid use and abundance at all aquatic habitat restoration projects.
- Continue stream temperature and stream flow monitoring.
- Monitor the aquatic benthic macro invertebrate community to determine changes and trends in the benthic community over time and as a result of implementation of aquatic habitat restoration projects.
- Continue to monitor adult anadromous salmonid escapement into Elk Creek.
- Monitor soil conditions to evaluate the effects of vegetation manipulation prescriptions as related to landscape structure and design strategy.
- Continue to monitor spotted owl demographics as an indicator of watershed health in the portion designated as LSR.
- Monitor road conditions and drainage.

- Monitor plantations for survival, vegetative competition and development.
- Monitor fuel levels and associated fire hazards.
- Monitor the scope and intensity of insect and disease occurrences.
- Monitor coarse woody debris levels and snag densities.
- Monitor terrestrial wildlife species habitat and distribution.
- Monitor non-native plant populations and encroachment.
- Monitor water diversions and compliance with water use permits.
- Monitor recreational use, hunting levels and use of special forest products.
- Monitor the effects of grazing on late-successional, riparian and aquatic values.

Appendix D
Salvage

Stand Exam Procedures

Initial units identified by Butte Falls Resource Area Inventory Specialist – Ed Park.
Areas where potential salvage existed were identified on post fire aerial photos. Stands of predominantly dead trees generally 5 acres and greater were identified and mapped for potential salvage. These areas typically were in the high and moderate fire severity areas. Crews took stand exams in these units.

Stand exam plots:

- 1 plot/5 acres on units >40 acres
- minimum 5 plots on units < 40 acres
- nested plots used to gather data
  - variable plot: > 8" trees, 20, 40 Basal Area Factor (BAF) used
  - fixed plot: 4"– 8" trees, 15.5' on 20 BAF plots, 11.0' on 40 BAF plots
  - CWD linear transect: 200' transect from plot center

Plot data collected

- tree type (Code numbers)
  - 11 – live trees
  - 12 – fire killed trees
  - 13 – 60% probability of mortality – (include definition of dying trees graph)
  - 14 – Hardwoods
  - 15 – Dead – pre-fire
  - 18 – No tree on plot
- Species
- DBH
- Tree height 1 plot/unit
- Live crown ratio (some trees)
- Plot crown closure
- Physiographic class
- Coarse Woody Debris (CWD) Class
- CWD length
- CWD intersect diameter
- CWD diameter @ small and large end

Data was entered into Atterbury Stand Exam Program. Statistical information reports from this program summarized information on overstory, understory, and coarse woody debris.

How other areas were sampled? (Low and very low/unburned)
Units were stratified based on the following criteria.

- Plant Series
  - ABCO
  - PSME
  - QUGA
- Seral Stage (pre-fire)
  - Early
  - Mid-
  - Late
- Aspect
  - North
  - South
- Burn Severity
  - High
  - Moderate
  - Low
  - Very low/Unburned
- Elevation
  - < 3500'
  - > 3500'

Within the low and very low/unburned severity areas, 17 stratifications were developed from these criteria. Within these stratifications, 10 percent of the acres were sampled with stand exams. Nested plots similar to original units were taken. In addition, a fixed plot for smaller trees and other vegetation (< 4" diameter) was gathered. Information from these stands was applied across all stands that fall within each stratification.

Definition of Dying Trees

Dying trees are defined as those trees that have a 60% or greater probablility of mortality due to the affects of fire. This probability is based upon a correlation of tree diameter (bark thickness) and the amount of crown scorch. The probablity of mortality of seven western conifers can be determined as a function of observed crown volume killed and bark thickness calculated from diameter at breast height (see Figure D-1).

Figure D-1. Probability of mortality of seven western conifers

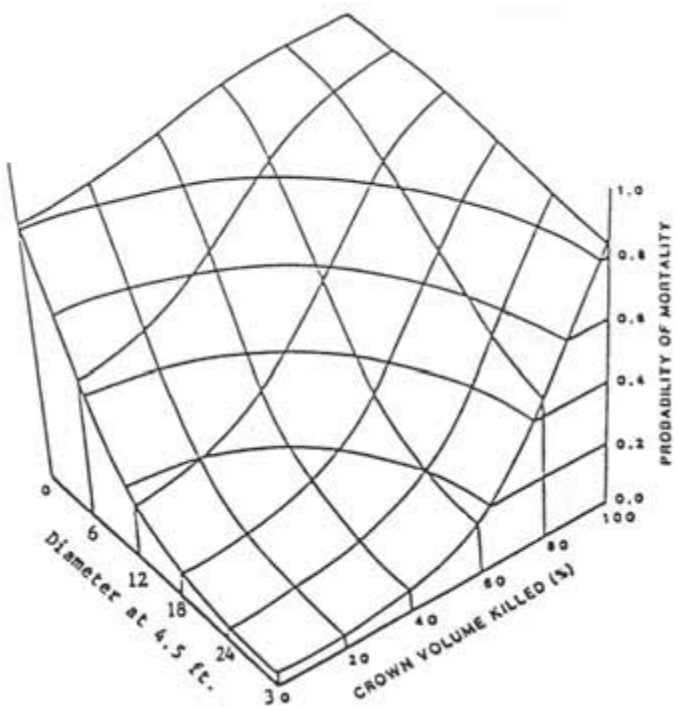


Table D-1. Comparison of Snag and CWD Levels by Alternative and Other Local References

	Alternative C	Alternative D	Alternative E	Alternative F	Alternative G	DecAID	Diane White Paper
	LSRA	DecAID 50/80	120 Linear ft. (16"x 16') +	Beschta	120 Linear ft. (16"x 16') +	30/50	
Salvaged							
Acres	247 acres	820 acres	1,930 acres	213 acres	679 acres		
Douglas-fir Plant Series							
Snags > 15"	Target 29 snags/acre. Snags provided in unsalvaged stands.						
Snags > 10"		Target 8 snags/acre. Snags provided in unsalvaged stands.					
Snags > 14"			Target 8 snags/acre.		Target 8 snags/acre. Snags provided in unsalvaged stands.		
Snags				2 acre patches within 3-10 acre salvage patches. Unmerchantable trees in harvest acres.		Target 5 snags/acre.	
Snags 10-19"							Douglas-fir Moist - PAG Decay class 1 and 2 4 snags/acre
Snags 20"+							Douglas-fir Moist - PAG Decay class 1 and 2 2 snags/acre

Table D-1. Comparison of Snag and CWD Levels by Alternative and Other Local References

	Alternative C	Alternative D	Alternative E	Alternative F	Alternative G	DecAID	Diane White Paper
	LSRA	DecAID 50/80	120 Linear ft. (16"x 16') +	Beschta		30/50	
CWD	CWD provided in unsalvaged stands and by existing CWD and unmerchantable trees within harvested units.	Target 3.6% ground cover. CWD provided in unsalvaged stands and by existing CWD and unmerchantable trees within harvest units.	120 linear ft+ nonmerchantable trees.	All existing and nonmerchantable trees.	Target 2.0% ground cover. CWD provided in unsalvaged stands and by existing CWD and unmerchantable trees within harvest units.	2.0 % ground cover	
CWD 10-19"							Decay class 1 and 2; 15 pieces/ acre; 5.8 tons/acre.
CWD 20"+							Decay class 1 and 2; 15 pieces/acre; 5.8 tons/acre.
White Fir Plant Series							
Snags >15"	Target 52 snags/acre. Snags provided in unsalvaged stands.						
Snags >10"		Target 17 snags/acre. Snags provided in unsalvaged stands.					
Snags >14"			Target 12 snags/acre		Target 12 snags/acre. Snags provided in unsalvaged stands.		
Snags				2 acre patches within 3-10 acre salvage patches. Unmerchantable trees in harvest acres.		Target 8 snags/ac	Douglas-fir-White Fir PAG Decay class 1 and 2 ; 17 snags/acre.

Table D-1. Comparison of Snag and CWD Levels by Alternative

	Alternative C	Alternative D	Alternative E	Alternative F	Alternative G	DecAID	Diane White Paper
	LSRA	DecAID 50/80	120 Linear ft. (16"x 16') +	Beschta		30/50	
CWD		Target 6.7% ground cover. CWD provided in unsalvaged stands and by existing CWD and unmerchantable trees within harvest units.	120 linear ft+ nonmerchantable.		Target 3.6% ground cover. CWD provided in unsalvaged stands and by existing CWD and unmerchantable trees within harvest units.	3.6 % ground cover	
CWD 20"+							Decay class 1 and 2; 8 pieces/acre; 1.8 tons/acre.
Research Units							
Acres					288 acres		
Snags> 20"					Target 6 snags/ac		
CWD					CWD provided in unsalvaged stands and by existing CWD and unmerchantable trees within harvest units.		
Unsalvaged Stand-Replacement							
Acres	2339 acres	1,766	656	2,373	1,625		
Douglas-fir Plant Series							
Snags > 15"	42 snags/acre						
Snags > 14"			27 snags/acre				
Snags > 10"	60 snags/acre			63 snags/acre	52 snags/ac		

Table D-1. Comparison of Snag and CWD Levels by Alternative

	Alternative C	Alternative D	Alternative E	Alternative F	Alternative G	DecAID	Diane White Paper
	LSRA	DecAID 50/80	120 Linear ft. (16"x 16') +	Beschta		30/50	
CWD	All existing and potential.	Average leave tree 13" dia. 53' ht. = 0.099% cover/tree. 6.6% groundcover.	Existing CWD.	All existing and nonmerchantable trees.	Average leave tree 13" dia. 53' ht. = 0.099% cover/tree. 5.1% groundcover.		
White Fir Plant Series							
Snags >15"	53 snags/acre						
Snags >10"		72 snags/acre		63 snags/acre	56 snags/ac		
Snags >14"			27 snags/acre.				
CWD	All existing and potential.	Average leave tree 16" dia. 59' ht. = 0.129% cover /tree. 9.1% ground cover.			Average leave tree 16" dia. 59' ht. = 0.129% cover /tree. 7.2% ground cover.		
Unsalvaged >40% canopy stands							
Acres	6,445	6,445	5,106	6,445	6,445		
Snags > 15"	3 snags/acre	6 snags/acre	1.5 snags/ac				
Snags > 10"				3 snags/acre	3 snags/acre		
CWD	All existing and potential.	All existing and potential.	Existing 128 linear ft./ac. and potential	All existing and potential.	All existing and potential.		
Salvage Areas > 40% canopy stands							
Acres			1,339 acres.				
Snags > 14"			4 snags/acre.				
CWD			120 linear ft/acre.				

Table D-2. Alternative C Snag and CWD Levels per Unit

A	B	C	D	E	F	G	H	I	J	K	L	M
AUNIT	Acres	Salvage Potential	Typical 15" - 18"	Existing 15"- 18"	Typical 19" - 22"	Existing 19" - 22"	Typical 23" +	Existing 23" +	(D+F+H) Total Typical	(E+G+I) Total Existing	(((K-J)/J)*100) % Existing Snag Level	(B*10 - 20%) Salvageable Acres
321e29u5	88	yes	7	10	6	8	16	28	29	46	59	18
321e7u4	86	yes	7	18	6	11	16	15	29	44	52	17
321e29u6	82	yes	7	8	6	11	16	20	29	39	34	16
321e29u7	76	yes	7	15	6	14	16	24	29	53	83	15
321e11u4	58	yes	7	15	6	4	16	17	29	36	24	12
321e3u3	43	yes	7	21	6	16	16	26	29	63	117	9
321e5u1	70	yes	13	28	11	5	28	25	52	58	12	8
321w13u1	42	yes	7	10	6	8	16	25	29	43	48	8
321w1u2	83	yes	13	13	11	11	28	30	52	54	4	8
321w1u6	69	yes	13	22	11	7	28	29	52	58	12	8
331e7u2	35	yes	7	19	6	11	16	16	29	46	59	7
321w1u11	38	yes	13	45	11	10	28	37	52	92	77	6
331e7u7	39	yes	7	17	6	7	16	9	29	33	14	5
331e8u1	27	yes	7	12	6	9	16	19	29	40	38	5
321e15u6	27	yes	7	8	6	13	16	21	29	42	45	5
321e29u8	26	yes	7	14	6	12	16	18	29	44	52	5
321e9u2	26	yes	7	13	6	3	16	20	29	36	24	5
321w25u4	26	yes	13	5	11	23	28	36	52	64	23	5
321e3u9	25	yes	7	22	6	11	16	10	29	43	48	5
321e17u5	24	yes	7	32	6	13	16	12	29	57	97	5
321e33u1	22	yes	7	20	6	13	16	10	29	43	48	4
321e17u7	21	yes	7	25	6	4	16	22	29	51	76	4
321e33u6LU	40	yes	7	15	6	7	16	9	29	31	7	4
321e17u1	19	yes	7	22	6	9	16	6	29	37	28	4
321e7u6	19	yes	13	50	11	24	28	13	52	87	67	4
321w24u2	38	yes	13	7	11	9	28	39	52	55	6	4
331w1u5	17	yes	7	4	6	19	16	32	29	55	90	3
321e19u5	16	yes	7	16	6	10	16	13	29	39	34	3
321w1u5	30	yes	13	12	11	5	28	35	52	52	0	3

Table D-2. Alternative C Snag and CWD Levels per Unit

A	B	C	D	E	F	G	H	I	J	K	L	M
AUNIT	Acres	Salvage Potential	Typical 15" - 18"	Existing 15"- 18"	Typical 19" - 22"	Existing 19" - 22"	Typical 23" +	Existing 23" +	(D+F+H) Total Typical	(E+G+I) Total Existing	(((K-J)/J)*100) % Existing Snag Level	(B*10 - 20%) Salvageable Acres
321e9u1	28	yes	7	10	6	8	16	11	29	29	0	3
331w1u6	14	yes	0	0	0	0	16	47	16	47	194	3
321w12u1	13	yes	13	36	11	6	28	21	52	63	21	3
331e5u1	13	yes	7	17	6	20	16	14	29	51	76	3
321e30u2	13	yes	13	51	11	27	28	23	52	101	94	3
321e3u5	14	yes	7	11	6	5	16	18	29	34	17	2
321e19u6	21	yes	13	12	0	0	28	30	41	42	2	2
331w1u4	11	yes	7	53	6	22	16	29	29	104	259	2
321e8u1	11	yes	13	38	11	12	28	15	52	65	25	2
321e5u5	10	yes	13	38	11	12	28	15	52	65	25	2
331w1u3	10	yes	7	11	6	11	16	30	29	52	79	2
331e7u4	10	yes	7	36	6	9	16	7	29	52	79	2
321e4u1	10	yes	7	16	6	9	16	14	29	39	34	2
321w11u3	18	yes	13	14	11	10	28	29	52	53	2	2
321e17u3	17	yes	7	13	6	7	16	10	29	30	3	2
321e9u3	15	yes	7	10	6	8	16	11	29	29	0	1
321e17u4	13	yes	7	13	6	7	16	10	29	30	3	1
321e29u3	13	yes	7	9	6	6	16	16	29	31	7	1
321e5u2	12	yes	13	22	11	9	28	22	52	53	2	1
321e33u4	11	yes	7	10	6	10	16	11	29	31	7	1
321w1u1	11	yes	13	14	0	0	28	28	41	42	2	1
321e7u10	10	yes	0	0	11	17	28	24	39	41	5	1
321e10u1	46	yes	13	16	11	10	28	24	52	50	-4	0
321e15u1	26	yes	13	19	11	8	28	18	52	45	-13	0
321e15u3	19	yes	13	19	11	9	28	2	52	30	-42	0
321e15u5	12	yes	13	6	11	7	28	28	52	41	-21	0
321e19u1	15	yes	13	15	11	13	28	6	52	34	-35	0
321e19u3	15	yes	13	48	11	12	28	15	52	75	44	0
321e19u4	34	yes	13	17	11	8	28	19	52	44	-15	0

Table D-2. Alternative C Snag and CWD Levels per Unit

A	B	C	D	E	F	G	H	I	J	K	L	M
AUNIT	Acres	Salvage Potential	Typical 15" - 18"	Existing 15"- 18"	Typical 19" - 22"	Existing 19" - 22"	Typical 23" +	Existing 23" +	(D+F+H) Total Typical	(E+G+I) Total Existing	(((K-J)/J)*100) % Existing Snag Level	(B*10 - 20%) Salvageable Acres
321e21u1	18	yes	13	6	11	2	28	23	41	31	-24	0
321e21u2	44	yes	7	12	6	5	16	8	29	25	-14	0
321e29u4	24	yes	13	17	11	5	28	18	52	40	-23	0
321e33u2	30	yes	7	10	6	2	16	8	29	20	-31	0
321e4u2	20	yes	7	9	6	5	16	7	29	21	-28	0
321e5u3	11	yes	13	18	11	10	28	23	52	51	-2	0
321e5u6LU	21	yes	13	18	11	10	28	23	52	51	-2	0
321w11u2	23	yes	13	18	11	4	28	18	52	40	-23	0
321w13u3	21	yes	13	10	11	7	28	5	52	22	-58	0
321w13u4	14	yes	13	2	11	2	28	24	52	28	-46	0
321w25u1	18	yes	13	10	11	4	28	29	52	43	-17	0
321w25u3	14	yes	13	0	11	6	28	25	52	31	-40	0
321w25u6	9	yes	13	30	11	4	28	32	52	66	27	0
331w1u2	20	yes	7	11	6	11	16	30	29	52	79	0
Total	**1,966**											**247**

Alternative D

Determination on the number of acres available for salvage in Alternative D using the DecAID Wood Advisor. Snag and CWD levels were determined based on a landscape approach. The following summarizes the calculations used in determining the levels of snags and CWD needed and the number of acres available for salvage within this alternative.

Determination of salvage acres within White Fir Plant Series

80% DecAID Tolerance Level
Total number of stand-replacement acres within White Fir Plant Series = 1138 acres
Acres available for salvage within 10-acre stand-replacement units = 872 acres
DecAID Target wildlife snags (10" DBH and greater) = 12 tpa
DecAID Target percent ground cover = 6.2%
Existing average snag size = 16.5" DBH and 60'
Percent ground cover of the average snag = 0.129% cover
Average existing percent ground cover = 1.55% cover
Average needed to meet Target ground cover = (Target - Existing) = 6.2% - 1.55% = 4.65%
Additional snags needed/acre to meet Target = average needed/existing average snag % ground cover = 4.65/0.129 = 36 tpa
Total Trees within available salvage acres in White Fir Plant Series >10" = 76,417 snags
Average tpa = 67 tpa

Wildlife snags - 12 snag/acre x 1138 acres =	13,656 snags
Additional snags to meet ground cover – 36 snags/acre x 1138 acres =	40,968 snags
Total snags needed to meet DecAID 80% Tolerance Level =	54,624 snags
Total trees within unavailable salvage acres (<10 acre units) >10" =	17,822 snags
Additional snags needed within salvage acres to meet Target =	36,802 snags
Number of acres needed to meet Target = 36,802/67 tpa =	549 acre
Number of acres available for harvest (872 -549) =	323 acres

Determination of salvage acres within Douglas-fir Plant Series

50% DecAID tolerance Level
Total Acres of stand replacement acres within DF Plant Series = 1448 acres
Acres available for salvage within 10 acre stand replacement units = 1112 acres
DecAID Target Wildlife Snags (10" DBH and greater) = 8 tpa
DecAID Target % ground cover = 3.6%
Existing average snag size = 13.5" DBH and 53'
% ground cover of the average snag = 0.099% cover
Average existing % ground cover = 0.69 % cover
Average needed to meet Target ground cover = (Target - Existing) = 3.6% - 0.69% = 2.91%
Additional snags needed/acre to meet Target = avg. needed/existing avg. snag % ground cover = 2.91/0.099 = 29 tpa
Total Trees w/in available salvage acres in WF Plant Series > 10" = 82,786 snags
Average tpa = 57 tpa

Wildlife snags - 8 snag/acre x 1448 acres =	11,584 snags
Additional snags to meet ground cover = 29 snags/acre x 1448 acres =	41,992 snags
Total snags needed to meet DecAID 50% Tolerance Level =	53,576 snags
Total trees within unavailable salvage acres (<10 acre units) >10" =	19,152 snags
Additional snags needed within salvage acres to meet target =	34,424 snags
Number of acres needed to meet target = 34,424/57 tpa =	604 acre
Number of acres available for harvest (1112 - 604) =	508 acres
Total Salvage Acres WF and DF plant series (508 + 323) =	831
(Minus USACE acres) (831 – 9) =	822

Table D-3. Alternative D Snag and CWD Levels by Unit

AUNIT	Plant Series	Acres	Total DecAid* Snags	Total Existing Snags	Existing % Cover** (cu. ft.)	DecAid Target % Cover***	Needed % Cover	Number of Trees Needed/Acre	Total Trees Needed	Number of Salvage Trees/Acre	Acres Available
331e7u1	PSME	28	8	10	0.13	3.60	3.47	61	69	-59	0
321e7u4	PSME	86	8	37	0.04	3.60	3.56	58	66	-29	0
321w14u2	ABCO	10	17	9	2.01	6.70	4.69	47	64	-55	0
321e4u2	ABCO	20	17	26	0.64	6.70	6.06	83	100	-74	0
321e5u6LU	ABCO	21	17	49	0.73	6.70	5.97	98	115	-66	0
321w13u3	ABCO	21	17	47	0.51	6.70	6.19	85	102	-55	0
321e3u4	PSME	21	8	25	0.24	3.60	3.36	46	54	-29	0
321e17u3	PSME	17	8	25	0.38	3.60	3.22	41	49	-24	0
321w23u1	ABCO	18	17	37	1.32	6.70	5.38	53	70	-33	0
321e15u3	ABCO	19	17	77	0.62	6.70	6.08	113	130	-53	0
321e17u4	PSME	13	8	25	0.38	3.60	3.22	41	49	-24	0
321w25u1	ABCO	18	17	37	0.86	6.70	5.84	39	56	-19	0
321e9u1	PSME	28	8	48	0.21	3.60	3.39	56	64	-16	0
321e19u6	ABCO	21	17	53	1.05	6.70	5.65	58	75	-22	20
321e8u1	ABCO	11	17	73	0.42	6.70	6.28	103	120	-47	0
321e5u5	ABCO	10	17	73	0.42	6.70	6.28	103	120	-47	0
321e4u1	ABCO	10	17	46	1.05	6.70	5.65	57	74	-28	0
321e19u7	ABCO	18	17	78	0.29	6.70	6.41	82	99	-21	0
321e9u3LU	PSME	14	8	48	0.21	3.60	3.39	56	64	-16	0
321e5u2	ABCO	12	17	66	1.10	6.70	5.60	72	89	-23	0
321e19u4	ABCO	34	17	62	0.62	6.70	6.08	51	68	-6	0
321e21u1	PSME	19	8	30	0.99	3.60	2.61	26	34	-4	0
321e7u10	ABCO	10	17	40	0.18	6.70	6.52	28	45	-5	0
321e29u4	ABCO	24	17	90	0.62	6.70	6.08	78	95	-5	0
321e15u5	ABCO	12	17	46	0.11	6.70	6.59	32	49	-3	0
321e3u5	PSME	14	8	35	0.87	3.60	2.73	28	36	-1	0
321e7u6	ABCO	22	17	107	0.33	6.70	6.37	82	99	8	3
321e29u2	ABCO	26	17	73	0.59	6.70	6.11	51	68	5	2

Table D-3. Alternative D Snag and CWD Levels by Unit

AUNIT	Plant Series	Acres	Total DecAid* Snags	Total Existing Snags	Existing % Cover** (cu. ft.)	DecAid Target % Cover***	Needed % Cover	Number of Trees Needed/Acre	Total Trees Needed	Number of Salvage Trees/Acre	Acres Available
321e5u7	PSME	11	8	73	0.42	3.60	3.18	52	60	13	2
321e17u1	ABCO	19	17	95	0.34	6.70	6.36	65	82	13	10
321e9u3	PSME	15	8	73	0.42	3.60	3.18	52	60	13	3
321e5u3	ABCO	11	17	56	3.65	6.70	3.05	24	41	15	7
321e9u2	PSME	26	8	52	1.29	3.60	2.31	38	46	6	13
321w13u4	ABCO	14	17	49	2.78	6.70	3.92	21	38	11	8
321w12u1	ABCO	13	17	45	2.23	6.70	4.47	17	34	11	10
321e29u3	PSME	13	8	56	0.32	3.60	3.28	33	41	15	23
331e7u6	QUGA	18	6	31	0.56	2.00	1.44	19	25	6	13
321e8u3	PSME	10	8	48	0.38	3.60	3.22	22	30	18	8
331w1u3	PSME	10	8	67	1.61	3.60	1.99	25	33	34	4
331e7u2	PSME	35	8	64	0.25	3.60	3.35	46	54	10	18
331e7u7	PSME	42	8	76	0.13	3.60	3.47	57	65	11	29
321w1u1	ABCO	11	17	53	4.85	6.70	1.85	6	23	30	6
331e8u1	PSME	27	8	58	0.75	3.60	2.85	37	45	13	12
321e19u5	PSME	16	8	78	0.74	3.60	2.86	37	45	33	10
321e33u4	QUGA	11	6	51	0.49	2.00	1.51	13	19	32	6
321e17u5	ABCO	24	17	98	0.51	6.70	6.19	52	69	29	14
321e19u3	ABCO	15	17	111	0.84	6.70	5.86	40	57	54	7
331e7u4	PSME	14	8	112	0.10	3.60	3.50	45	53	59	10
331w1u6	PSME	14	8	48	0.92	3.60	2.68	13	21	27	8
321w1u10LU	ABCO	18	17	70	2.18	6.70	4.52	22	39	31	7
321e15u6	PSME	27	8	42	0.40	3.60	3.20	22	30	12	14
331e5u1	PSME	13	8	83	0.63	3.60	2.97	20	28	55	10
321w25u3	ABCO	14	17	63	5.07	6.70	1.63	5	22	41	10
331w1u4	PSME	11	8	192	1.02	3.60	2.58	17	25	167	5
321w13u1	ABCO	42	17	70	1.21	6.70	5.49	37	54	16	18
321w25u4	ABCO	26	17	79	2.00	6.70	4.70	32	49	30	20

Table D-3. Alternative D Snag and CWD Levels by Unit

AUNIT	Plant Series	Acres	Total DecAid* Snags	Total Existing Snags	Existing % Cover** (cu. ft.)	DecAid Target % Cover***	Needed % Cover	Number of Trees Needed/Acre	Total Trees Needed	Number of Salvage Trees/Acre	Acres Available
331w1u2	PSME	20	8	67	1.61	3.60	1.99	25	33	34	0
331w1u5	PSME	17	8	53	1.96	3.60	1.64	14	22	31	7
321e3u9	PSME	24	8	58	1.64	3.60	1.96	25	33	25	8
321e33u1	QUGA	22	6	63	0.41	2.00	1.59	26	32	31	13
321w11u2	ABCO	23	17	72	4.13	6.70	2.57	20	37	35	15
321e15u1	PSME	26	8	88	0.47	3.60	3.13	40	48	40	15
321e29u8	PSME	26	8	62	1.23	3.60	2.37	23	31	31	14
321e30u2	ABCO	20	17	164	0.64	6.70	6.06	41	58	106	15
321w1u5	ABCO	30	17	57	1.76	6.70	4.94	13	30	27	20
321w11u3	ABCO	18	17	69	7.66	6.70	-0.96	-3	14	55	13
321e17u7	PSME	21	8	67	1.19	3.60	2.41	13	21	46	10
321w24u2	ABCO	33	17	57	1.14	6.70	5.56	15	32	25	15
321e21u2	PSME	44	8	99	0.15	3.60	3.45	57	65	34	17
321w1u2	ABCO	61	17	64	0.97	6.70	5.73	31	48	16	24
321e11u4&10u1**		80	12	59	0.74	5	4.26	35	47	12	40
321e33u2	PSME	30	8	80	0.38	3.60	3.22	27	35	45	21
321w1u11LU	ABCO	35	17	130	0.61	6.70	6.09	41	58	72	19
321e5u1	ABCO	70	17	91	1.01	6.70	5.69	47	64	27	27
321e33u6LU	PSME	40	8	80	0.38	3.60	3.22	27	35	45	15
321w1u6	ABCO	38	17	70	3.40	6.70	3.30	9	26	44	17
321e3u3	PSME	43	8	58	0.77	3.60	2.83	14	22	36	16
321e29u6	PSME	82	8	52	1.34	3.60	2.26	18	26	26	48
321e29u5	PSME	88	8	62	1.19	3.60	2.41	19	27	35	52
321e29u7	PSME	76	8	79	0.96	3.60	2.64	14	22	57	49
Total		**2036**									**820**

* DecAID Snag Density: Southwest Oregon Mixed Conifer-Hardwood Forest, Larger Trees
**DecAID % Cover: Table 1 Conifer-Harwood Forest SMall/Medium and Larger Trees
***DeAID Target % Cover: Southwest Oregon Mixed Conifer-Hardwood Forest, Larger Trees

What Is the DecAID Advisor?

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DecAID -- Work in Progress on a Decayed Wood Advisor for Washington and Oregon
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Introduction

Decayed wood elements -- snags, down wood, and live decaying trees -- are habitat for many organisms that live in terrestrial ecosystems, and contribute to other aspects of ecosystem productivity and diversity. Maintaining an adequate level and mixture of these habitat elements can be a challenging task for any forest land manager. An advisory system called “DecAID” is being developed from a new synthesis of data and research results pertaining to forests in Oregon and Washington. The DecAID Advisor is a planning tool intended to help advise and guide managers as they conserve and manage snags, partially dead trees, and down wood for biodiversity.

DecAID is an advisory tool to help managers evaluate effects, of forest conditions and existing or proposed management activities on organisms that use snags and down wood. DecAID also can help managers decide on snag and down wood sizes and levels needed to help meet wildlife management objectives. It can help managers articulate those objectives in specific, quantitative terms that could be tested in the field. In this way, the name “DecAID” can be read as decayed wood advisor and management aid (“decay-aid” or “decision-aid”). The DecAID Advisor can help long-term planning, as over “decades” of time.

Background

Wildlife species models and advisory tools related to managing decayed wood elements (principally, snags and down wood) on federal lands in the Pacific Northwest were first developed in the 1970s and 1980s (Thomas and others 1979, Neitro and others 1985, Marcot 1992, Raphael 1983), including some snag dynamics models (e.g., Morrison and Raphael 1993, Marcot 1992). Although these tools were based on sound empirical information and expert knowledge available at the time, the data and model structures have become outdated. A considerable amount of new information about the ecology, dynamics, and management of decayed wood has become available since the 1980s. There has been an evolution in thinking of snags and down wood just as habitat structures for terrestrial vertebrates, to thinking of decaying wood in the broadest sense as an integral part of complex ecosystems and ecological processes.

Several key themes prevalent in recent literature include:

- decayed wood elements consist of more than just snags and down wood, such as live trees with dead tops or stem decay
- decayed wood provides habitat and resources for a wider array of organisms and their ecological functions than previously thought
- “wood decay” is an ecological process important to far more organisms than just terrestrial vertebrates (“wildlife” in the traditional sense). Also, more recent field studies, particularly in eastern Oregon (e.g., Bull and others 1997),

suggest that the amounts and sizes of snags selected by wildlife are far greater than those depicted by existing models.

Because of the extensive amount of new information and ideas published over the past twenty years, it was apparent that the empirical foundation of existing models needed to be updated and revised (e.g., see synthesis in Rose and others 2001). The DecAID Advisor is being developed to fill this need.

What is DecAID?

The DecAID Advisor arose from the recognition by Pacific Northwest Region, USDA Forest Service, of the growing need to update guidelines for managing snags and down wood. It was described in the wildlife Species Habitat Project of Washington and Oregon (Rose and others 2001, Johnson and O'Neil 2001). DecAID developed into a major data synthesis project under USDA Forest Service, Pacific Northwest Region, and Pacific Northwest Research Station, Portland, Oregon, with contributions of expertise from USDI Fish and Wildlife Service, and other agencies and institutions.

Modeling biological potential of wildlife species (particularly only of primary cavity excavator birds) has been used in the past, and we developed the DecAID Advisor to avoid some pitfalls associated with that approach. There is no direct relationship between the statistical summaries presented in DecAID and past calculations or models of biological potential. Field studies have suggested that predictions of biological potential (relative or absolute population sizes of snag-associated wildlife species) do not match research findings.

DecAID is organized around "vegetation conditions" that combine wildlife habitat type, vegetation alliance, structural condition (average tree size and canopy closure), and geographic location (subregion). Wildlife habitat types and structural conditions as used in DecAID were derived from the wildlife habitats and structural conditions defined in the Species Habitat Project (Chappell and others 2001).

DecAID provides interpretation and advice on the roles of insects and pathogens in the creation and dynamics of dead wood, and the implications of snag and down wood management on ecosystem health, and offers mitigation considerations. It includes information and advice on relationships between forest insects and pathogens and snag and down wood management, and summarizes the occurrences of specific pathogens within various vegetation conditions.

DecAID also provides a summary of forest inventory data representing the range of "natural" (unharvested) and current conditions of snags and down wood in forests of all ownerships and disturbance histories. The DecAID Advisor presents information from research studies and inventories about range of natural conditions where available, and can be used to help identify knowledge gaps and areas of needed research. DecAID describes fungi associated with decayed wood in Oregon and Washington, including a summary of their ecological roles, the importance of dead wood to fungi, and considerations for maintenance of fungal biodiversity. At present, DecAID does not specifically address effects of fire.

Because forest management has evolved to address forests as ecological communities and dynamic ecosystems, DecAID addresses far more than just wildlife (terrestrial vertebrate) use of snags and down wood. Ecosystem management acknowledges how organisms link to their environments and how human activities influence more than just individual species. In this spirit, DecAID provides information on the array of key ecological functions and functional groups of wildlife that use snags and down wood, and can be used to describe the impact of changing snag and down wood levels on those functions and functional groups.

On What is DecAID Based?

DecAID is a summary, synthesis, and integration of published scientific literature, research data, wildlife databases, forest inventory databases, and expert judgment and experience. The information presented on wildlife species use of snags and down wood is based entirely on scientific field research and does not rely on modeling the biological potential of wildlife populations.

The information presented on ranges of snag and down wood amounts under natural and current conditions is based on forest inventories, research studies, and other sources. Forest inventories include: the Current Vegetation Survey (CVS), conducted by USDA Forest Service, Pacific Northwest Region, on National Forest lands; the Forest Inventory and Analysis (FIA), conducted by USDA Forest Service, Pacific Northwest Research Station, on nonfederal lands; and the Natural Resource Inventory (NRI), conducted by USDI Bureau of Land Management (BLM) on BLM lands in western Oregon. Inventory plot data are unavailable for reserved areas outside BLM lands and National Forests, such as on National and State Parks.

The information on insects and pathogens is based on empirical studies, CVS, NRI, and FIA inventory data, and expert understanding of potential effects.

For the current version of the DecAID Advisor, December 2000 was the cutoff date for incorporating papers and data sources, with a few additional sources added after that date if the data were readily available and served to fill critical data gaps. To select the studies to include in DecAID, we relied primarily on published literature and theses that had empirical data on wildlife use of size and amount of dead wood. Data used in the wildlife cumulative species curves were those on mean, variance, and sample size. For use in the down wood cumulative curves, the data needed to be reported in units that we could convert to percent cover, such as down wood volume. Data on down wood reported as pieces of down wood per unit area were not able to be converted to percent cover of down wood.

Studies since December 2000 that we selected to also include were those for which we had already used in the form of theses or progress reports, and that had been subsequently formally published in peer-reviewed literature as of August 2002 (the date of our formal peer review of the DecAID Advisor). We did not solicit unpublished data to include, but we accepted it when it was volunteered through the peer review process.

Components of DecAID

DecAID contains an extensive amount of information. However, it is not all-encompassing and it is important to clarify what it can and can not do.

DecAID is:

- a thorough review of published literature and other available data on wildlife use of decayed wood elements, primarily in Oregon and Washington
- a statistical synthesis of data showing levels of use by individual wildlife species of decayed wood elements
- a summary of the patterns of use of decayed wood elements by wildlife speciesin Oregon and Washington (number of species using specific snag or down wood sizes or amounts
- statistical summaries of forest inventory data on snags and down wood in unharvested forests and entire landscapes across Oregon and Washington
- a helpful tool for making informed decisions

DecAID is NOT:

- a forest stand growth simulator
- a snag and down wood decay simulator or recruitment model
- a wildlife population simulator or analysis of wildlife population viability
- a substitute for making professional decisions based on experience

Also, DecAID does not address decayed wood elements in aquatic or riparian environments, although we recognize the high value of such elements in providing habitat for associated fish, wildlife, invertebrate, and other species.

Who Could Use DecAID?

DecAID is being developed with the intent for use across all land ownerships in Washington and Oregon. The DecAID Advisor will be useful to a wide array of private, commercial, city, county, state, and federal land managers, as well as planners, policymakers, and researchers. Our DecAID science team (see authors) consists of wildlife biologists, research ecologists, forest inventory specialists, forest entomologists, and mycologists. The team also consulted with professionals from diverse specialties including wildlife research, fire ecology, timber management, plant pathology, silviculture, and land use planning.

We intend DecAID to be used broadly by land planners, timber consultants, and forest managers. We hope the DecAID Advisor serves as a template for use in other geographic areas, given similar literature reviews, research data, and summaries of expert judgments.

How Can DecAID Be Used?

DecAID presents information on wildlife use of snag diameter, snag density, down wood diameter, and down wood percent cover, and on the range of natural (unharvested) and current (all) conditions of snag density and down wood percent cover by diameter classes. The information is presented at three statistical tolerance levels which may be interpreted as three levels of "assurance:" low (30% tolerance level), moderate (50% tolerance level), and high (80% tolerance level). Minimum and maximum values are also presented. Additional available data on dead wood species, decay condition, etc. are summarized but not analyzed statistically.

DecAID allows the user to specify a vegetation condition, and to:

- view a synthesis of empirical data on wildlife use of wood decay elements in Washington and Oregon;
- determine which selected wildlife species would be associated with specific sizes or amounts of snags or down wood at various statistical levels;
- determine the sizes or amounts of snags or down wood to meet specified wildlife species objectives;
- view a narrative interpretation of these data along with the literature sources;
- view summaries of the range of snag and down wood levels in unharvested forest, representing ranges of natural conditions, and across all current forest conditions;
- determine effects of present or expected stand conditions on wildlife using
- wood decay elements;
- determine implications of insect and pathogen activity on the creation and management of snags and down wood for wildlife habitat;
- view advice on the roles of insects and pathogens in creation and dynamics of snags and down wood; and
- determine implications of snag and down wood levels on managing for overall forest ecosystem health.

Paying Attention to Scales of Space and Time

A critical consideration in use of DecAID is that of scales of space and time. DecAID will be best applied at scales of subwatersheds, watersheds, subbasins, physiographic provinces, or large administrative units such as Ranger Districts, National Forests, or BLM Districts.

DecAID is not intended to predict occurrence of wildlife species at the scale of individual forest stands or specific locations – there are far too many other factors influencing the presence or absence of organisms at that scale than could be reasonably depicted here. DecAID is not intended to predict the specific species composition in a given geographic area. Instead, it is intended to be used to help advise on broad, cumulative patterns of species occurrence and distributions in generally-described habitat types and structural conditions. Validation of other wildlife-habitat relationships databases (for example, Dedon and others 1986, Fielding and Haworth 1995, Raphael and Marcot 1986) suggests that any information of this type would likely err on the side of commission, that is, including species that may not really occur on any one site, particularly with smaller geographic areas such as an individual forest stand. DecAID is intended to be a broader planning aid than a species- or stand-specific prediction tool.

Because DecAID is not a time-dynamic simulator (such as Marcot 1992 for snags; Mellen and Ager 2002 for snags and down wood; and Bragg 2000, for down wood in riparian systems), it does not account for potential temporal changes in vegetation and other environmental conditions, species functional and numerical responses, population dynamics and demographics, fire likelihoods, and ecosystem health. DecAID could be consulted to review potential conditions at specific time intervals and for a specific set of conditions, but dynamic changes in forest and landscape conditions would have to be modeled or evaluated outside the confines of the DecAID Advisor.

Regarding the use of inventory data to represent ranges of natural and current conditions, the dead wood estimates must be interpreted in light of the inherent scale imposed by the inventory designs. Each observation that entered our summaries was an individual field plot. Each plot encompassed about a one- or two-hectare area, within which snags were sampled on fixed- or variable-radius subplots and down wood was sampled on line transects. Plot area, subplot sizes, and transect lengths varied somewhat within and among the data sets. Within-plot variability is not represented in this study. Also, because the plots sampled an area that is smaller than a typical forest stand, the plot-level observations should not be thought of as representing

stand-level conditions. Rather, our summaries describe the aggregate properties of the variability of dead wood on multiple plots that sample a given wildlife habitat. We believe it is reasonable to apply distributional information about dead wood that is based on many inventory plots in a given vegetation condition to a management "unit" at the scale of a landscape or sub-watershed.

Also, the distribution and estimated variation of dead wood within each wildlife habitat is the result of the interaction between plot size and the spatial pattern of dead wood. Smaller plot sizes would result in greater variability, since smaller plots are more likely to sample dense clumps of dead wood or fall in gaps where no dead wood exists.

Although the estimates of amounts of dead wood are from plots measured at a single point in time, the current conditions express events that have occurred over the past decades to centuries.

Availability, Progress, and Related References

As of this writing, the DecAID project is an ongoing, dynamic process. The DecAID Advisor will be available as a Web site operating as an interactive program. Current plans include training sessions to help users understand how to run the program and use and interpret results.

We have presented work to date in other publications. An overview of DecAID was provided in Mellen and others (2002). The wildlife component of DecAID was described in Marcot and others (2002) and the ecological functions of wildlife pertaining to decayed wood were presented by Marcot (2002) and Marcot and Vander Heyden (2001). The forest inventory summaries were described in Ohmann and Waddell (2002). The ecosystem productivity implications of decayed wood were presented in Rose and others (2001).

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Printed from DecAID web site: http://www.fs.fed.us/wildecology/decaid/decaid_background/decaid_whatis.htm

Table D-4. Alternative E Snag and CWD Levels by Unit

AUNIT	Burn Severity	Acres	Snags	CWD Level
321e15u10g	low/very low burn	2	4/acre	120 Linear ft.
321e15u11g	low/very low burn	41	4/acre	120 Linear ft.
321e15u9g	low/very low burn	2	4/acre	120 Linear ft.
321e17u13g	low/very low burn	2	4/acre	120 Linear ft.
321e19u11g	low/very low burn	29	4/acre	120 Linear ft.
321e19u12g	low/very low burn	9	4/acre	120 Linear ft.
321e19u13g	low/very low burn	9	4/acre	120 Linear ft.
321e19u14g	low/very low burn	49	4/acre	120 Linear ft.
321e19u15g	low/very low burn	5	4/acre	120 Linear ft.
321e19u16g	low/very low burn	3	4/acre	120 Linear ft.
321e19u17g	low/very low burn	2	4/acre	120 Linear ft.
321e21u4g	low/very low burn	5	4/acre	120 Linear ft.
321e29u11g	low/very low burn	8	4/acre	120 Linear ft.
321e29u12g	low/very low burn	5	4/acre	120 Linear ft.
321e31u4g	low/very low burn	2	4/acre	120 Linear ft.
321e31u5g	low/very low burn	3	4/acre	120 Linear ft.
321e3u10g	low/very low burn	10	4/acre	120 Linear ft.
321e3u6g	low/very low burn	2	4/acre	120 Linear ft.
321e3u7g	low/very low burn	6	4/acre	120 Linear ft.
321e3u9g	low/very low burn	2	4/acre	120 Linear ft.
321e4u6g	low/very low burn	2	4/acre	120 Linear ft.
321e4u7g	low/very low burn	32	4/acre	120 Linear ft.
321e5u16g	low/very low burn	69	4/acre	120 Linear ft.
321e5u17g	low/very low burn	2	4/acre	120 Linear ft.
321e5u18g	low/very low burn	2	4/acre	120 Linear ft.
321e5u19g	low/very low burn	36	4/acre	120 Linear ft.
321e5u20g	low/very low burn	3	4/acre	120 Linear ft.
321e5u21g	low/very low burn	11	4/acre	120 Linear ft.
321e5u22g	low/very low burn	2	4/acre	120 Linear ft.
321e5u23g	low/very low burn	6	4/acre	120 Linear ft.
321e5u24g	low/very low burn	4	4/acre	120 Linear ft.
321e7u18g	low/very low burn	5	4/acre	120 Linear ft.
321e7u19g	low/very low burn	47	4/acre	120 Linear ft.
321e7u20g	low/very low burn	13	4/acre	120 Linear ft.
321e7u21g	low/very low burn	33	4/acre	120 Linear ft.
321e7u22g	low/very low burn	11	4/acre	120 Linear ft.
321e7u23g	low/very low burn	2	4/acre	120 Linear ft.
321e7u24g	low/very low burn	2	4/acre	120 Linear ft.
321e7u25g	low/very low burn	4	4/acre	120 Linear ft.
321e7u26g	low/very low burn	8	4/acre	120 Linear ft.
321e8u10g	low/very low burn	3	4/acre	120 Linear ft.
321e8u11g	low/very low burn	6	4/acre	120 Linear ft.
321e8u12g	low/very low burn	5	4/acre	120 Linear ft.
321e8u13g	low/very low burn	4	4/acre	120 Linear ft.
321e8u8g	low/very low burn	7	4/acre	120 Linear ft.

Table D-4. Alternative E Snag and CWD Levels by Unit

AUNIT	Burn Severity	Acres	Snags	CWD Level
321e8u9g	low/very low burn	50	4/acre	120 Linear ft.
321e9u7g	low/very low burn	7	4/acre	120 Linear ft.
321w11u10g	low/very low burn	14	4/acre	120 Linear ft.
321w11u11g	low/very low burn	2	4/acre	120 Linear ft.
321w11u12g	low/very low burn	4	4/acre	120 Linear ft.
321w11u6g	low/very low burn	6	4/acre	120 Linear ft.
321w11u7g	low/very low burn	10	4/acre	120 Linear ft.
321w11u8g	low/very low burn	2	4/acre	120 Linear ft.
321w11u9g	low/very low burn	15	4/acre	120 Linear ft.
321w12u4g	low/very low burn	4	4/acre	120 Linear ft.
321w12u5g	low/very low burn	26	4/acre	120 Linear ft.
321w12u6g	low/very low burn	16	4/acre	120 Linear ft.
321w12u7g	low/very low burn	74	4/acre	120 Linear ft.
321w12u8g	low/very low burn	10	4/acre	120 Linear ft.
321w13u10g	low/very low burn	7	4/acre	120 Linear ft.
321w13u11g	low/very low burn	2	4/acre	120 Linear ft.
321w13u12g	low/very low burn	19	4/acre	120 Linear ft.
321w13u13g	low/very low burn	10	4/acre	120 Linear ft.
321w13u14g	low/very low burn	6	4/acre	120 Linear ft.
321w13u15g	low/very low burn	2	4/acre	120 Linear ft.
321w13u16g	low/very low burn	2	4/acre	120 Linear ft.
321w13u17g	low/very low burn	12	4/acre	120 Linear ft.
321w13u18g	low/very low burn	23	4/acre	120 Linear ft.
321w13u19g	low/very low burn	3	4/acre	120 Linear ft.
321w13u20g	low/very low burn	3	4/acre	120 Linear ft.
321w13u21g	low/very low burn	23	4/acre	120 Linear ft.
321w14u4g	low/very low burn	2	4/acre	120 Linear ft.
321w14u5g	low/very low burn	7	4/acre	120 Linear ft.
321w14u6g	low/very low burn	14	4/acre	120 Linear ft.
321w14u7g	low/very low burn	22	4/acre	120 Linear ft.
321w14u8g	low/very low burn	2	4/acre	120 Linear ft.
321w14u9g	low/very low burn	9	4/acre	120 Linear ft.
321w1u25g	low/very low burn	17	4/acre	120 Linear ft.
321w1u27g	low/very low burn	6	4/acre	120 Linear ft.
321w1u28g	low/very low burn	4	4/acre	120 Linear ft.
321w1u29g	low/very low burn	3	4/acre	120 Linear ft.
321w1u30g	low/very low burn	11	4/acre	120 Linear ft.
321w1u31g	low/very low burn	7	4/acre	120 Linear ft.
321w1u32g	low/very low burn	59	4/acre	120 Linear ft.
321w1u33g	low/very low burn	5	4/acre	120 Linear ft.
321w1u34g	low/very low burn	3	4/acre	120 Linear ft.
321w1u35g	low/very low burn	8	4/acre	120 Linear ft.
321w1u36g	low/very low burn	2	4/acre	120 Linear ft.
321w1u37g	low/very low burn	2	4/acre	120 Linear ft.
321w1u38g	low/very low burn	3	4/acre	120 Linear ft.

Table D-4. Alternative E Snag and CWD Levels by Unit

AUNIT	Burn Severity	Acres	Snags	CWD Level
321w23u2g	low/very low burn	18	4/acre	120 Linear ft.
321w23u3g	low/very low burn	11	4/acre	120 Linear ft.
321w24u4g	low/very low burn	7	4/acre	120 Linear ft.
321w24u5g	low/very low burn	13	4/acre	120 Linear ft.
321w24u6g	low/very low burn	5	4/acre	120 Linear ft.
321w25u10g	low/very low burn	18	4/acre	120 Linear ft.
321w25u11g	low/very low burn	45	4/acre	120 Linear ft.
321w25u12g	low/very low burn	16	4/acre	120 Linear ft.
321w25u13g	low/very low burn	22	4/acre	120 Linear ft.
321w25u14g	low/very low burn	2	4/acre	120 Linear ft.
321w25u7g	low/very low burn	102	4/acre	120 Linear ft.
321w25u8g	low/very low burn	27	4/acre	120 Linear ft.
321w25u9g	low/very low burn	23	4/acre	120 Linear ft.
Total Acres Low/Very Low		**1,362**		
321e10u1	high/moderate burn	11	6 - 14/acre	120 Linear ft.
321e10u2	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321e10u3	high/moderate burn	18	6 - 14/acre	120 Linear ft.
321e10u4	high/moderate burn	1	6 - 14/acre	120 Linear ft.
321e11u1	high/moderate burn	3	6 - 14/acre	120 Linear ft.
321e11u2	high/moderate burn	8	6 - 14/acre	120 Linear ft.
321e11u3	high/moderate burn	19	6 - 14/acre	120 Linear ft.
321e11u4	high/moderate burn	53	6 - 14/acre	120 Linear ft.
321e15u1	high/moderate burn	21	6 - 14/acre	120 Linear ft.
321e15u10	high/moderate burn	3	6 - 14/acre	120 Linear ft.
321e15u11	high/moderate burn	1	6 - 14/acre	120 Linear ft.
321e15u2	high/moderate burn	6	6 - 14/acre	120 Linear ft.
321e15u3	high/moderate burn	4	6 - 14/acre	120 Linear ft.
321e15u4	high/moderate burn	4	6 - 14/acre	120 Linear ft.
321e15u5	high/moderate burn	10	6 - 14/acre	120 Linear ft.
321e15u6	high/moderate burn	19	6 - 14/acre	120 Linear ft.
321e15u7	high/moderate burn	9	6 - 14/acre	120 Linear ft.
321e15u8	high/moderate burn	1	6 - 14/acre	120 Linear ft.
321e15u9	high/moderate burn	1	6 - 14/acre	120 Linear ft.
321e17u1	high/moderate burn	14	6 - 14/acre	120 Linear ft.
321e17u10	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321e17u11	high/moderate burn	1	6 - 14/acre	120 Linear ft.
321e17u12	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321e17u2	high/moderate burn	7	6 - 14/acre	120 Linear ft.
321e17u3	high/moderate burn	35	6 - 14/acre	120 Linear ft.
321e17u4	high/moderate burn	11	6 - 14/acre	120 Linear ft.
321e17u5	high/moderate burn	8	6 - 14/acre	120 Linear ft.
321e17u6	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321e17u7	high/moderate burn	10	6 - 14/acre	120 Linear ft.
321e17u8	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321e17u9	high/moderate burn	3	6 - 14/acre	120 Linear ft.

Table D-4. Alternative E Snag and CWD Levels by Unit

AUNIT	Burn Severity	Acres	Snags	CWD Level
321e19u1	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321e19u10	high/moderate burn	3	6 - 14/acre	120 Linear ft.
321e19u2	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321e19u3	high/moderate burn	9	6 - 14/acre	120 Linear ft.
321e19u4	high/moderate burn	24	6 - 14/acre	120 Linear ft.
321e19u5	high/moderate burn	16	6 - 14/acre	120 Linear ft.
321e19u6	high/moderate burn	20	6 - 14/acre	120 Linear ft.
321e19u7	high/moderate burn	18	6 - 14/acre	120 Linear ft.
321e19u8	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321e19u9	high/moderate burn	3	6 - 14/acre	120 Linear ft.
321e21u1	high/moderate burn	15	6 - 14/acre	120 Linear ft.
321e21u2	high/moderate burn	23	6 - 14/acre	120 Linear ft.
321e21u3	high/moderate burn	3	6 - 14/acre	120 Linear ft.
321e27u1	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321e29u1	high/moderate burn	6	6 - 14/acre	120 Linear ft.
321e29u10	high/moderate burn	6	6 - 14/acre	120 Linear ft.
321e29u2	high/moderate burn	28	6 - 14/acre	120 Linear ft.
321e29u3	high/moderate burn	11	6 - 14/acre	120 Linear ft.
321e29u4	high/moderate burn	23	6 - 14/acre	120 Linear ft.
321e29u5	high/moderate burn	81	6 - 14/acre	120 Linear ft.
321e29u6	high/moderate burn	30	6 - 14/acre	120 Linear ft.
321e29u7	high/moderate burn	50	6 - 14/acre	120 Linear ft.
321e29u8	high/moderate burn	19	6 - 14/acre	120 Linear ft.
321e29u9	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321e30u2	high/moderate burn	19	6 - 14/acre	120 Linear ft.
321e31u1	high/moderate burn	3	6 - 14/acre	120 Linear ft.
321e31u2	high/moderate burn	5	6 - 14/acre	120 Linear ft.
321e31u3	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321e33u1	high/moderate burn	18	6 - 14/acre	120 Linear ft.
321e33u2	high/moderate burn	42	6 - 14/acre	120 Linear ft.
321e33u4	high/moderate burn	6	6 - 14/acre	120 Linear ft.
321e3u1	high/moderate burn	3	6 - 14/acre	120 Linear ft.
321e3u10	high/moderate burn	4	6 - 14/acre	120 Linear ft.
321e3u11	high/moderate burn	1	6 - 14/acre	120 Linear ft.
321e3u12	high/moderate burn	3	6 - 14/acre	120 Linear ft.
321e3u13	high/moderate burn	4	6 - 14/acre	120 Linear ft.
321e3u14	high/moderate burn	1	6 - 14/acre	120 Linear ft.
321e3u15	high/moderate burn	7	6 - 14/acre	120 Linear ft.
321e3u16	high/moderate burn	1	6 - 14/acre	120 Linear ft.
321e3u17	high/moderate burn	1	6 - 14/acre	120 Linear ft.
321e3u18	high/moderate burn	4	6 - 14/acre	120 Linear ft.
321e3u2	high/moderate burn	4	6 - 14/acre	120 Linear ft.
321e3u3	high/moderate burn	12	6 - 14/acre	120 Linear ft.
321e3u4	high/moderate burn	12	6 - 14/acre	120 Linear ft.
321e3u5	high/moderate burn	1	6 - 14/acre	120 Linear ft.

Table D-4. Alternative E Snag and CWD Levels by Unit

AUNIT	Burn Severity	Acres	Snags	CWD Level
321e3u6	high/moderate burn	1	6 - 14/acre	120 Linear ft.
321e3u7	high/moderate burn	3	6 - 14/acre	120 Linear ft.
321e3u8	high/moderate burn	4	6 - 14/acre	120 Linear ft.
321e3u9	high/moderate burn	3	6 - 14/acre	120 Linear ft.
321e4u1	high/moderate burn	9	6 - 14/acre	120 Linear ft.
321e4u2	high/moderate burn	11	6 - 14/acre	120 Linear ft.
321e4u3	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321e4u4	high/moderate burn	1	6 - 14/acre	120 Linear ft.
321e4u5	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321e5u1	high/moderate burn	5	6 - 14/acre	120 Linear ft.
321e5u10	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321e5u11	high/moderate burn	1	6 - 14/acre	120 Linear ft.
321e5u12	high/moderate burn	3	6 - 14/acre	120 Linear ft.
321e5u13	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321e5u14	high/moderate burn	1	6 - 14/acre	120 Linear ft.
321e5u15	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321e5u2	high/moderate burn	8	6 - 14/acre	120 Linear ft.
321e5u3	high/moderate burn	6	6 - 14/acre	120 Linear ft.
321e5u4	high/moderate burn	1	6 - 14/acre	120 Linear ft.
321e5u5	high/moderate burn	5	6 - 14/acre	120 Linear ft.
321e5u6	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321e5u7	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321e5u8	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321e5u9	high/moderate burn	31	6 - 14/acre	120 Linear ft.
321e7u1	high/moderate burn	3	6 - 14/acre	120 Linear ft.
321e7u10	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321e7u11	high/moderate burn	7	6 - 14/acre	120 Linear ft.
321e7u12	high/moderate burn	6	6 - 14/acre	120 Linear ft.
321e7u13	high/moderate burn	25	6 - 14/acre	120 Linear ft.
321e7u14	high/moderate burn	5	6 - 14/acre	120 Linear ft.
321e7u15	high/moderate burn	1	6 - 14/acre	120 Linear ft.
321e7u16	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321e7u17	high/moderate burn	1	6 - 14/acre	120 Linear ft.
321e7u2	high/moderate burn	5	6 - 14/acre	120 Linear ft.
321e7u3	high/moderate burn	5	6 - 14/acre	120 Linear ft.
321e7u4	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321e7u5	high/moderate burn	4	6 - 14/acre	120 Linear ft.
321e7u6	high/moderate burn	4	6 - 14/acre	120 Linear ft.
321e7u7	high/moderate burn	25	6 - 14/acre	120 Linear ft.
321e7u8	high/moderate burn	3	6 - 14/acre	120 Linear ft.
321e7u9	high/moderate burn	3	6 - 14/acre	120 Linear ft.
321e8u1	high/moderate burn	1	6 - 14/acre	120 Linear ft.
321e8u2	high/moderate burn	3	6 - 14/acre	120 Linear ft.
321e8u3	high/moderate burn	10	6 - 14/acre	120 Linear ft.
321e8u4	high/moderate burn	3	6 - 14/acre	120 Linear ft.

Table D-4. Alternative E Snag and CWD Levels by Unit

AUNIT	Burn Severity	Acres	Snags	CWD Level
321e8u5	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321e8u6	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321e8u7	high/moderate burn	4	6 - 14/acre	120 Linear ft.
321e9u1	high/moderate burn	1	6 - 14/acre	120 Linear ft.
321e9u2	high/moderate burn	19	6 - 14/acre	120 Linear ft.
321e9u3	high/moderate burn	11	6 - 14/acre	120 Linear ft.
321e9u4	high/moderate burn	4	6 - 14/acre	120 Linear ft.
321e9u5	high/moderate burn	13	6 - 14/acre	120 Linear ft.
321e9u6	high/moderate burn	1	6 - 14/acre	120 Linear ft.
321e9u7	high/moderate burn	1	6 - 14/acre	120 Linear ft.
321e9u8	high/moderate burn	1	6 - 14/acre	120 Linear ft.
321e9u9	high/moderate burn	3	6 - 14/acre	120 Linear ft.
321w11u1	high/moderate burn	5	6 - 14/acre	120 Linear ft.
321w11u2	high/moderate burn	21	6 - 14/acre	120 Linear ft.
321w11u3	high/moderate burn	13	6 - 14/acre	120 Linear ft.
321w11u4	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321w11u5	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321w12u1	high/moderate burn	13	6 - 14/acre	120 Linear ft.
321w12u2	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321w12u3	high/moderate burn	3	6 - 14/acre	120 Linear ft.
321w13u1	high/moderate burn	17	6 - 14/acre	120 Linear ft.
321w13u2	high/moderate burn	7	6 - 14/acre	120 Linear ft.
321w13u3	high/moderate burn	21	6 - 14/acre	120 Linear ft.
321w13u4	high/moderate burn	14	6 - 14/acre	120 Linear ft.
321w13u5	high/moderate burn	5	6 - 14/acre	120 Linear ft.
321w13u6	high/moderate burn	1	6 - 14/acre	120 Linear ft.
321w13u7	high/moderate burn	4	6 - 14/acre	120 Linear ft.
321w13u8	high/moderate burn	3	6 - 14/acre	120 Linear ft.
321w13u9	high/moderate burn	1	6 - 14/acre	120 Linear ft.
321w14u1	high/moderate burn	8	6 - 14/acre	120 Linear ft.
321w14u2	high/moderate burn	8	6 - 14/acre	120 Linear ft.
321w14u3	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321w1u1	high/moderate burn	7	6 - 14/acre	120 Linear ft.
321w1u10	high/moderate burn	3	6 - 14/acre	120 Linear ft.
321w1u11	high/moderate burn	31	6 - 14/acre	120 Linear ft.
321w1u12	high/moderate burn	3	6 - 14/acre	120 Linear ft.
321w1u13	high/moderate burn	12	6 - 14/acre	120 Linear ft.
321w1u14	high/moderate burn	3	6 - 14/acre	120 Linear ft.
321w1u15	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321w1u16	high/moderate burn	1	6 - 14/acre	120 Linear ft.
321w1u17	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321w1u18	high/moderate burn	5	6 - 14/acre	120 Linear ft.
321w1u19	high/moderate burn	4	6 - 14/acre	120 Linear ft.
321w1u2	high/moderate burn	17	6 - 14/acre	120 Linear ft.
321w1u20	high/moderate burn	2	6 - 14/acre	120 Linear ft.

Table D-4. Alternative E Snag and CWD Levels by Unit

AUNIT	Burn Severity	Acres	Snags	CWD Level
321w1u21	high/moderate burn	4	6 - 14/acre	120 Linear ft.
321w1u22	high/moderate burn	3	6 - 14/acre	120 Linear ft.
321w1u23	high/moderate burn	3	6 - 14/acre	120 Linear ft.
321w1u24	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321w1u3	high/moderate burn	26	6 - 14/acre	120 Linear ft.
321w1u4	high/moderate burn	41	6 - 14/acre	120 Linear ft.
321w1u5	high/moderate burn	28	6 - 14/acre	120 Linear ft.
321w1u6	high/moderate burn	57	6 - 14/acre	120 Linear ft.
321w1u7	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321w1u8	high/moderate burn	1	6 - 14/acre	120 Linear ft.
321w1u9	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321w23u1	high/moderate burn	18	6 - 14/acre	120 Linear ft.
321w24u1	high/moderate burn	6	6 - 14/acre	120 Linear ft.
321w24u2	high/moderate burn	27	6 - 14/acre	120 Linear ft.
321w24u3	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321w25u1	high/moderate burn	16	6 - 14/acre	120 Linear ft.
321w25u2	high/moderate burn	5	6 - 14/acre	120 Linear ft.
321w25u3	high/moderate burn	14	6 - 14/acre	120 Linear ft.
321w25u4	high/moderate burn	26	6 - 14/acre	120 Linear ft.
321w25u5	high/moderate burn	2	6 - 14/acre	120 Linear ft.
321w25u6	high/moderate burn	9	6 - 14/acre	120 Linear ft.
331e10u1	high/moderate burn	3	6 - 14/acre	120 Linear ft.
331e10u2	high/moderate burn	20	6 - 14/acre	120 Linear ft.
331e10u3	high/moderate burn	2	6 - 14/acre	120 Linear ft.
331e10u4	high/moderate burn	2	6 - 14/acre	120 Linear ft.
331e15u	high/moderate burn	2	6 - 14/acre	120 Linear ft.
331e15u1	high/moderate burn	4	6 - 14/acre	120 Linear ft.
331e15u2	high/moderate burn	3	6 - 14/acre	120 Linear ft.
331e17u1	high/moderate burn	4	6 - 14/acre	120 Linear ft.
331e17u2	high/moderate burn	5	6 - 14/acre	120 Linear ft.
331e3u	high/moderate burn	2	6 - 14/acre	120 Linear ft.
331e3u1	high/moderate burn	6	6 - 14/acre	120 Linear ft.
331e3u2	high/moderate burn	2	6 - 14/acre	120 Linear ft.
331e3u3	high/moderate burn	4	6 - 14/acre	120 Linear ft.
331e3u4	high/moderate burn	3	6 - 14/acre	120 Linear ft.
331e3u5	high/moderate burn	3	6 - 14/acre	120 Linear ft.
331e3u6	high/moderate burn	7	6 - 14/acre	120 Linear ft.
331e3u7	high/moderate burn	4	6 - 14/acre	120 Linear ft.
331e3u8	high/moderate burn	5	6 - 14/acre	120 Linear ft.
331e3u9	high/moderate burn	2	6 - 14/acre	120 Linear ft.
331e5u1	high/moderate burn	13	6 - 14/acre	120 Linear ft.
331e5u2	high/moderate burn	6	6 - 14/acre	120 Linear ft.
331e5u3	high/moderate burn	1	6 - 14/acre	120 Linear ft.
331e5u3	high/moderate burn	3	6 - 14/acre	120 Linear ft.
331e5u3	high/moderate burn	5	6 - 14/acre	120 Linear ft.

Table D-4. Alternative E Snag and CWD Levels by Unit

AUNIT	Burn Severity	Acres	Snags	CWD Level
331e5u4	high/moderate burn	2	6 - 14/acre	120 Linear ft.
331e6u1	high/moderate burn	2	6 - 14/acre	120 Linear ft.
331e7u1	high/moderate burn	1	6 - 14/acre	120 Linear ft.
331e7u2	high/moderate burn	32	6 - 14/acre	120 Linear ft.
331e7u3	high/moderate burn	2	6 - 14/acre	120 Linear ft.
331e7u4	high/moderate burn	11	6 - 14/acre	120 Linear ft.
331e7u5	high/moderate burn	4	6 - 14/acre	120 Linear ft.
331e7u6	high/moderate burn	45	6 - 14/acre	120 Linear ft.
331e7u7	high/moderate burn	7	6 - 14/acre	120 Linear ft.
331e7u8	high/moderate burn	1	6 - 14/acre	120 Linear ft.
331e8u1	high/moderate burn	17	6 - 14/acre	120 Linear ft.
331w1u1	high/moderate burn	6	6 - 14/acre	120 Linear ft.
331w1u10	high/moderate burn	1	6 - 14/acre	120 Linear ft.
331w1u11	high/moderate burn	4	6 - 14/acre	120 Linear ft.
331w1u12	high/moderate burn	2	6 - 14/acre	120 Linear ft.
331w1u2	high/moderate burn	12	6 - 14/acre	120 Linear ft.
331w1u3	high/moderate burn	2	6 - 14/acre	120 Linear ft.
331w1u4	high/moderate burn	1	6 - 14/acre	120 Linear ft.
331w1u5	high/moderate burn	2	6 - 14/acre	120 Linear ft.
331w1u6	high/moderate burn	9	6 - 14/acre	120 Linear ft.
331w1u7	high/moderate burn	3	6 - 14/acre	120 Linear ft.
331w1u8	high/moderate burn	2	6 - 14/acre	120 Linear ft.
331w1u9	high/moderate burn	4	6 - 14/acre	120 Linear ft.
Total Acres High/Moderate		**1,954**		

Table D-5. Alternative F Snag and CWD Levels per Unit

AUNIT	Stand Acres	Potential Salvage Acres	Available Salvage Acres
321e10u2	3	1	1
321e11u3	4	2	2
321e15u1	9	7	7
321e15u10	6	4	3
321e15u2	8	6	6
321e15u4	8	6	5
321e15u6	8	6	3
321e17u2	9	7	7
321e17u7	7	5	5
321e17u8	3	1	1
321e17u9	3	1	1
321e19u1	4	2	2
321e19u10	3	1	1
321e19u8	3	1	1
321e19u9	3	1	1
321e21u3	6	4	4
321e29u10	6	4	4
321e29u3	9	7	7
321e31u1	3	1	1
321e31u2	5	3	3
321e3u1	3	1	1
321e3u10	4	2	2
321e3u11	4	2	1
321e3u12	3	1	1
321e3u2	4	2	2
321e3u6	5	3	1
321e5u14	3	1	1
321e5u4	3	1	1
321e5u5	10	8	5
321e7u1	3	1	1
321e7u10	10	8	2
321e7u11	8	6	6
321e7u12	6	4	4
321e7u13LU	3	1	1
321e7u14	7	5	5
321e7u3	5	3	3
321e7u8	4	2	2
321e8u3	10	8	8
321e8u4	3	1	1
321e8u7	4	2	2
321e9u4	4	2	2
321w11u1	5	3	3
321w11u4	3	1	1
321w12u3	3	1	1

Table D-5. Alternative F Snag and CWD Levels per Unit

AUNIT	Stand Acres	Potential Salvage Acres	Available Salvage Acres
321w13u2	8	6	6
321w13u7	6	4	4
321w13u8	4	2	2
321w14u1	8	6	5
321w14u2	10	8	8
321w1u12	3	1	1
321w1u14	4	2	2
321w1u16	4	2	1
321w1u18	5	3	3
321w1u19	4	2	2
321w1u21	5	3	3
321w1u22	4	2	2
321w1u23	3	1	1
321w1u8	3	1	1
321w24u1	6	4	4
321w25u2	5	3	3
321w25u6	9	7	7
331e10u1	3	1	1
331e15u3	7	5	4
331e15u2	3	1	1
331e17u1	7	5	4
331e3u3	4	2	2
331e3u4	3	1	1
331e5u2	9	7	6
331e5u3	6	4	4
331e7u3	3	1	1
331e7u5	4	2	2
331e7u8	3	1	1
331w1u1	7	5	5
331w1u3	10	8	2
331w1u7	9	7	3
Total Acres			214

NOTE: Potential Salvage Acres equal (Stand acres minus 2 acres for snags)
Available Salvage Acres equal (Potential salvage acres minus additional riparian acres within stand)

Alternative G Snag and CWD Levels

In determining the recommended levels of snags and CWD in Alternative G, outside of the research units, a number of references were considered. A review of these references shows that recommendations for snags and CWD were very similar. Recommended snag levels from the following references were considered:

Guidelines for Snag and Down Wood Prescriptions in Southwestern Oregon (Diane White 2001)
Effects of Stand Replacement Fire and Salvage Logging on a Cavity Nesting Bird Community in Eastern Cascades,Washington (Haggard and Gaines 2001)
Jenny Creek Late-Successional Reserve Assessment (LSRA) (2000)
DecAID Wood Advisor (Mellen, et al.)

These references were related either to recommendations for cavity nesting species (i.e. Haggard and Gaines) or were specific recommendations for southwest Oregon (i.e. White paper, Jenny Creek LSRA, DecAID). The Haggard and Gaines recommendations were included because they provided a range of snag levels which would provide the "highest abundance, species richness, and nesting population of cavity nesters" (Haggard and Gaines, 2001). It is acknowledged that this study was completed in Eastern Cascades of Washington but it was felt conditions were similar to those in southwest Oregon and the recommendations should be considered. The three other references included make specific recommendations for southwest Oregon.

Table D-5 contains a comparison of these references and the recommended snag and CWD levels.

Table D-6. Comparison of Recommended Snag and CWD Levels by Reference

	Diane White Paper		Haggard & Gaines		Jenny Creek LSRA		DecAID Advisor	
	Snags	CWD	Snags	CWD	Snags	CWD	Snags	CWD
White Fir Plant Series	>10", 6 tpa	13 pieces/acre or 9.8 tons/ acre or 2.5 % cover	> 10", 6-14 tpa	No CWD level recommended	> 8", 15 tpa; > 16", 7-14 tpa	Range 5-7 pieces/acre (16" x 16") or 0.84% ground cover	50-80% range, 8-17 tpa	50-80% range, 3.6-6.7% ground cover
Douglas-fir Plant Series	>10", 6 tpa	8 pieces/acre or 5.3 tons/ acre or 1.1% cover					30-50% range, 5-8 tpa	30-50% range, 2.0-3.6% ground cover

A landscape approach was used in determining the snags and CWD levels in Alternative G, outside of the research units. Snag and CWD levels would be applied across all stand-replacement units on BLM-administered land. It does not consider or make up for snag levels on private land. Based on these recommendations, the following snag and CWD target levels were proposed for Alternative G.

Table D-7. Recommended Snag and CWD Levels for Alternative G

	Snags > 16"	CWD
White Fir Plant Series	12	3.6 % ground cover
Douglas-fir Plant Series	8	2.0 % ground cover

Alternative G

Determination on the number of snags needed to meet the 30% and 50% DecAID levels for nonresearch salvage units in Alternative G using the DecAID Wood Advisor follows. This was considered a minimum level for this alternative. Snag and CWD levels were determined based on a landscape approach.

Determination of salvage acres within White Fir Plant Series

50% DecAID Tolerance Level
Total Acres of stand-replacement acres within White Fir Plant Series = 1,138 acres
Acres available for salvage within 10-acre stand-replacement units = 872 acres
DecAID Target Wildlife Snags (10" DBH and greater) = 8 tpa
DecAID Target % ground cover = 3.6%
Existing average snag size = 16.5" DBH and 60'
% ground cover of the average snag = 0.129% cover
Average existing % ground cover = 1.55% cover
Average needed to meet Target ground cover = (Target - Existing) = 3.6% - 1.55% = 2.05%
Additional snags needed/acre to meet Target = average needed/existing average snag % ground cover = 2.05/0.129 = 17 tpa
Total Trees within available salvage acres in White Fir Plant Series > 10" = 76,417 snags
Average tpa = 67 tpa

Wildlife snags - 8 snag/acre x 1,138 acres =	9,104 snags
Additional snags to meet ground cover = 17 snags/acre x 1138 acres =	19,346 snags
Total snags needed to meet DecAID 50% Tolerance Level =	28,450 snags
Total trees within unavailable salvage acres (<10 acre units) >10" =	17,822 snags
Additional snags needed within salvage acres to meet target = (28450 – 17,822)	10,628 snags
Number of snags/acre needed on Salvage units = 10,628/872 =	12 snags/acre

Determination of salvage acres within Douglas-fir Plant Series

30% DecAID Tolerance Level
Total Acres of stand-replacement acres within Douglas-fir Plant Series = 1,448 acres
Acres available for salvage within 10-acre stand-replacement units = 1,112 acres
DecAID Target Wildlife Snags (10" DBH and greater) = 5 tpa
DecAID Target % ground cover = 2.0%
Existing average snag size = 13.5" DBH and 53'
% ground cover of the average snag = 0.099% cover
Average existing % ground cover = 0.69% cover
Average needed to meet Target ground cover = (Target - Existing) = 2.0% - 0.69% = 1.31%
Additional snags needed/acre to meet Target = average needed/existing average snag % ground cover = 1.31/0.099 = 13 tpa
Total Trees w/in available salvage acres in WF Plant Series > 10" = 82,786 snags
Average tpa = 57 tpa

Wildlife snags - 5 snag/acre x 1448 acres =	7,240 snags
Additional snags to meet ground cover = 13 snags/acre x 1448 acres =	18,824 snags
Total snags needed to meet DecAID 30% Tolerance Level =	26,064 snags
Total trees w/in unavailable salvage acres (<10-acre units) > 10" =	19,152 snags
Additional snags needed w/in salvage acres to meet target =	6,912 snags
Number of snags/acre needed on Salvage units = 6,912/1112 =	6 snags/acre

It is anticipated additional snags and CWD would be provided for in the salvaged units because many trees in the 10" to 16" DBH range would not be merchantable due to the delay in implementation of the salvage activities. These were not considered in meeting the target levels but it is assumed they would provide additional levels. It is estimated 80% of the trees from 10-16" DBH within the salvaged units would not be salvaged. This would provide an average of 15 snags/acre and 3.6% cover in the White Fir plant series and 2.8% cover in the Douglas-fir plant series across the landscape.

Table D-8. Alternative G Harvest Units and Systems

Original Unit	Original Unit Acres	Series	Salvageable Unit	Harvest Acres	Harvest System	Comment
321e10u3	34	ABCO	321e10u3	25	cable	
321e11u4	53	PSME	321e11u4	37	helicopter	research
321e15u1	23	PSME	321e15u1t	9	tractor	
			321e15u1tc	10	cable	
321e15u3	4	ABCO	321e15u3	2	bull line	
321e15u4	7	ABCO	321e15u4	3	bull line	
321e15u5	13	ABCO	321e15u5	6	cable	
321e15u6	19	PSME	321e15u6c	9	cable	
			321e15u6t	6	tractor	
321e15u7	9	ABCO	321e15u7	5	bull line	
321e17u4c	13	PSME	321e17u4c	11	helicopter	
321e17u4	23	PSME	321e17u4h	5	helicopter	
	0	PSME	321e17u4t	10	tractor	
321e17u5	8	ABCO	321e17u5	4	cable	
321e17u7	10	PSME	321e17u7	8	cable	
321e19u4	32	ABCO	321e19u4	32	cable	research
321e19u5	16	PSME	321e19u5c	3	cable	
			321e19u5t	10	tractor	
321e19u6	21	ABCO	321e19u6	14	cable	
321e19u7	17	ABCO	321e19u7	11	cable	
321e21u1c	15	PSME	321e21u1c	10	cable	
321e21u2	27	PSME	321e21u2	14	helicopter	
			321e21u2a	5	tractor	
321e29u1	20	ABCO	321e29u1	14	cable	
321e29u4	35	ABCO	321e29u4	23	cable	
321e29u5c	43	PSME	321e29u5c	43	cable	research
321e29u5t	10	PSME	321e29u5t	7	tractor	
321e29u6	38	PSME	321e29u6	15	cable	research
			321e29u6a	7	tractor	research
			321e29u6b	16	helicopter	research
321e29u7	57	PSME	321e29u7A	35	cable	research
			321e29u7A	5	helicopter	research
321e30u2c	19	ABCO	321e30u2c	8	cable	
			321e30u2h	8	tractor	
321e33u1	13	ABCO	321e33u1	9	cable	
321e33u4	7	ABCO	321e33u4	4	bull line	
321e3u13	4	PSME	321e3u13	4	helicopter	
321e3u18	4	PSME	321e3u18	3	helicopter	
321e3u3	15	PSME	321e3u3	8	bull line	
			321e3u3a	5	cable	
321e3u8	4	PSME	321e3u8	3	cable	
321e3u9	3	PSME	321e3u9	2	bull line	

Table D-8. Alternative G Harvest Units and Systems

Original Unit	Original Unit Acres	Series	Salvageable Unit	Harvest Acres	Harvest System	Comment
321e4u1	12	ABCO	321e4u1	9	helicopter	
321e4u2	43	ABCO	321e4u2	14	helicopter	
321e5u13	2	ABCO	321e5u13	1	helicopter	
321e5u1E	34	ABCO	321e5u1E	11	cable	research
			321e5u1E	23	helicopter	research
321e5u2	8	ABCO	321e5u2	6	cable	
321e5u3	6	ABCO	321e5u3	3	helicopter	
321e5u5	5	ABCO	321e5u5	3	helicopter	
321e7u13	25	ABCO	321e7u13	12	cable	
321e7u14	20	ABCO	321e7u14	7	bull line	
321e7u5	11	ABCO	321e7u5	9	cable	
321e7u6	3	ABCO	321e7u6	1	bull line	
321e7u7	24	PSME	321e7u7	15	cable	
321e7u8	2	ABCO	321e7u8	2	cable	
321e8u3	10	ABCO	321e8u3	5	cable	
321e8u6	5	ABCO	321e8u6	4	cable	
321e9u2	23	PSME	321e9u2c	9	cable	
			321e9u2h	7	helicopter	
321e9u5	3	PSME	321e9u5	2	cable	
321w11u2	21	ABCO	321w11u2c	1	cable	
			321w11u2h	12	helicopter	
321w11u3	13	ABCO	321w11u3	10	helicopter	
321w12u1	6	ABCO	321w12u1	5	helicopter	
321w12u1a	8	ABCO	321w12u1a	6	cable	
321w13u1	17	ABCO	321w13u1	12	helicopter	
321w13u3	21	ABCO	321w13u3	3	cable	
			321w13u3a	5	helicopter	
321w13u4	14	ABCO	321w13u4	8	cable	
321w13u5	5	ABCO	321w13u5	4	helicopter	
321w14u1	13	ABCO	321w14u1	9	helicopter	
321w1u1	7	ABCO	321w1u1	5	helicopter	
321w1u13	12	ABCO	321w1u13	8	helicopter	
321w1u18	21	ABCO	321w1u18	11	helicopter	adjusted tpa for openings
321w1u2	45	ABCO	321w1u2	32	helicopter	research
321w1u2A	17	ABCO	321w1u2A	13	helicopter	
321w1u5	28	ABCO	321w1u5	20	helicopter	
321w1u6	8	ABCO	321w1u6	8	helicopter	FMZ: leave 6 tpa
321w24u1	10	ABCO	321w24u1	4	helicopter	
321w24u2	37	ABCO	321w24u2	26	helicopter	research
321w25u1	11	ABCO	321w25u1	6	cable	
321w25u3c	14	ABCO	321w25u3c	6	cable	
			321w25u3tb	3	bull line	

Table D-8. Alternative G Harvest Units and Systems

Original Unit	Original Unit Acres	Series	Salvageable Unit	Harvest Acres	Harvest System	Comment
321w25u4	26	ABCO	321w25u4	12	helicopter	
			321w25u4t	7	tractor	
321w25u6	9	ABCO	321w25u6	6	tractor	
331e5u1	13	PSME	331e5u1	11	tractor	
331e5u2	6	PSME	331e5u2	5	helicopter	
331e7u2	32	PSME	331e7u2	16	tractor	
			331e7u2a	10	cable	
331e7u4	11	PSME	331e7u4	10	helicopter	
331e7u7A	7	PSME	331e7u7A	6	helicopter	
331e7u7h	32	PSME	331e7u7h	13	helicopter	
			331e7u7t	12	tractor	
331e8u1	17	PSME	331e8u1	13	helicopter	
331w1u11	4	PSME	331w1u11	4	helicopter	
331w1u6	9	PSME	331w1u6	7	helicopter	
331w1u9	4	PSME	331w1u9	4	helicopter	
Total	**1349**			**961**		

Reserve tree selection guidelines

Reserve tree types and hazard areas

1995

Fig. 3. — Reserve tree Type 1.

Reserve tree types — conifer only

Recognizing reserve tree types is the first step in identifying potential hazard areas. These definitions are based upon conditions that affect the tree's stability that are visible to an observer on the ground.

They are divided into four classifications, ranging from the safest to the most dangerous.

For example, Type 1 reserve trees have low-hazard and low-failure probability, while Type 4 reserve trees have extreme-hazard and extreme-failure probability. Non-defective, healthy green trees are not classified. All reserve trees fit one of these types.

Specific defects which could cause failure must be evaluated for each reserve tree.

When a reserve tree type is questionable, it should be assigned the next higher type.

Type 1 reserve trees are live-green trees that are defective or deformed with sound tops, trunks, and roots (Fig. 3).

They may have part of the top broken out or have evidence of other defects that include "cat face," animal chewing, old logging wound, weather injury, insect attack, or lightning strike.

Because these trees are stable, they pose the least hazard to workers.

Type 1 trees may be retained wherever live-green trees can be retained safely.

Reserve tree selection guidelines

Reserve tree types and hazard areas

1995

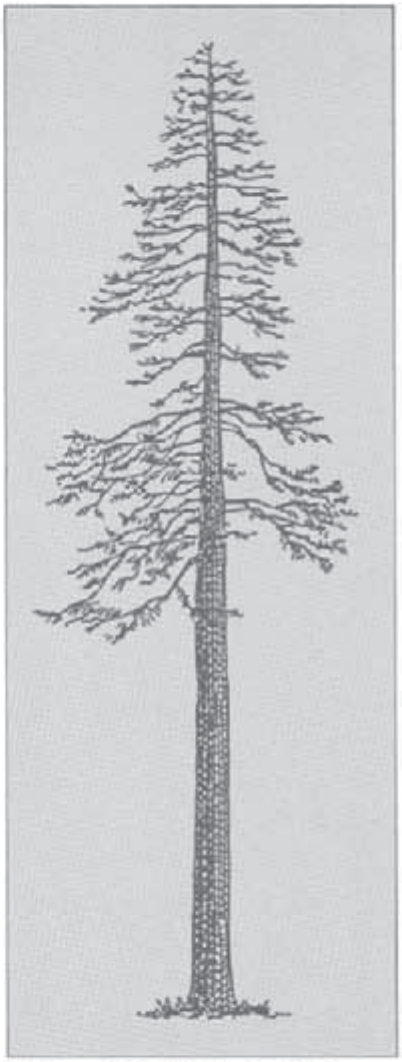


Fig. 4. — Reserve tree Type 2.

A **Type 2** reserve tree is a dead tree with sound top, trunk, and roots (Fig. 4).

Identifying Type 2 reserve trees requires careful observation. Mortality may have been caused by canker, diseases, insects, fire, adverse weather or lightning. Needle and small twig retention is evidence of recent death, which may be an indicator of stability.

Fire-scorched trees may remain stable for many years if the trunk and root systems are not badly burned. However, not all fire-scarred trees may be safe. Preexisting defects may be charred and difficult to detect, rendering a tree that was dangerous before the fire even more dangerous afterward.

A tree classified as Type 2 may move to a Type 4 as a result of natural decay and deformation or if its roots have been damaged by fire or weakened by root rot.

Because Type 2 reserve trees have stable tops, trunks, and roots, they may be retained wherever healthy, green trees could be retained safely.

Reserve tree selection guidelines

Reserve tree types and hazard areas

1995

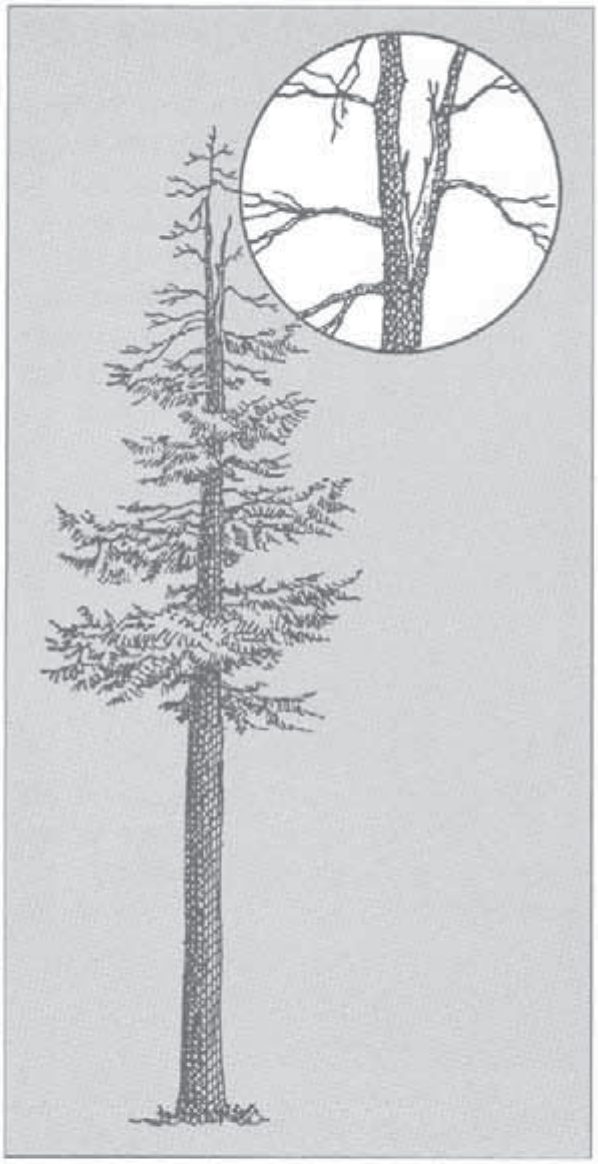


Fig. 5. — Reserve tree Type 3.

Type 3 trees are live or dead trees with unstable tops or upper portions (Fig. 5).

Although the roots and main portions of the trunk are sound, these reserve trees pose high hazard because of defect in live or dead wood higher up in the tree. Ground vibration from falling trees, wind, flying debris, heavy equipment or other industrial activity can dislodge slabs, chunks, limbs, or the entire upper portion of the tree.

Because these reserve trees do not collapse at the base, but somewhere above, testing the tree at breast height will not give an accurate indication of the tree's condition at a higher location where failures are likely to occur.

The area on the ground that could be reached by a dislodged top, slab or chunk is called the "hazard area" for a Type 3 reserve tree.

In determining the hazard area, evaluate the following criteria:

- Slope of the ground.
- Amount and direction of lean — must be easily observable.
- Length of the top portion that would dislodge.

Reserve tree selection guidelines

Reserve tree types and hazard areas

1995

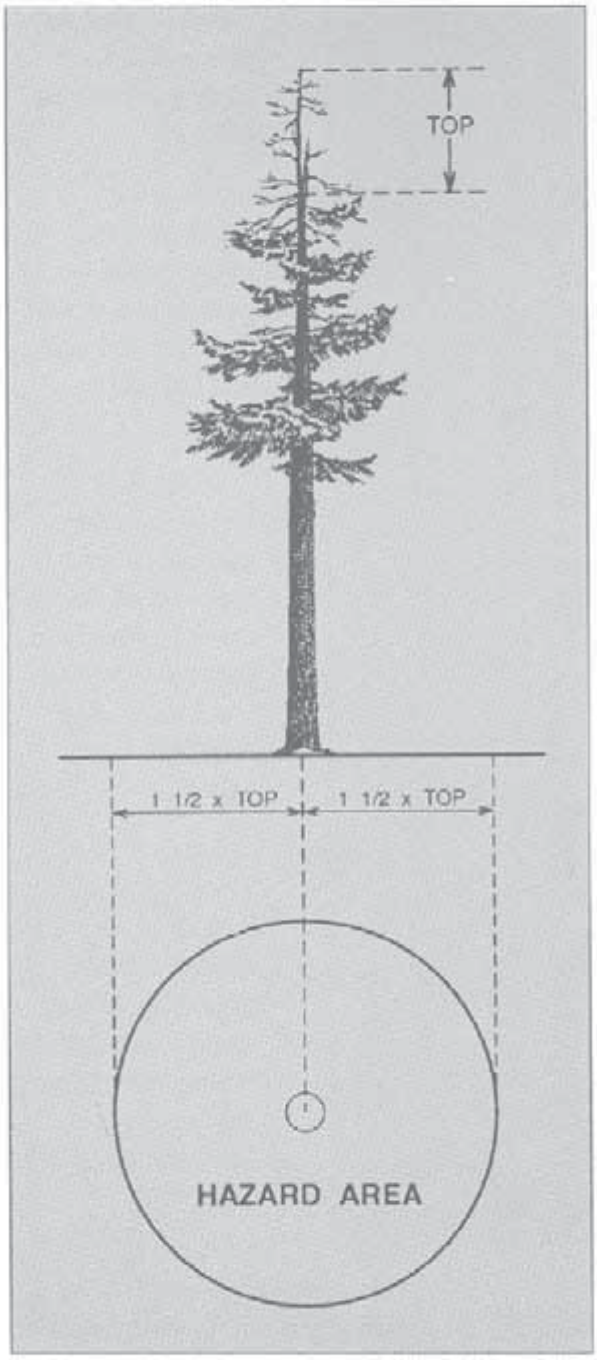


Fig. 6. — Hazard area for a Type 3 reserve tree with no discernible lean.

Level or sloped ground ... no discernible lean (Fig. 6).

Step 1. Determine the length of the top or portion that would dislodge and at least one half of its length.

Step 2. The hazard area forms a circle around the tree with a radius equal to at least 1 1/2 times the length of the dislodged portion.*

** On sloped ground where the dislodged section may roll down hill, the hazard area must be extended on the down-hill side for whatever distance is necessary to protect workers.*

Reserve tree selection guidelines

Reserve tree types and hazard areas

1995

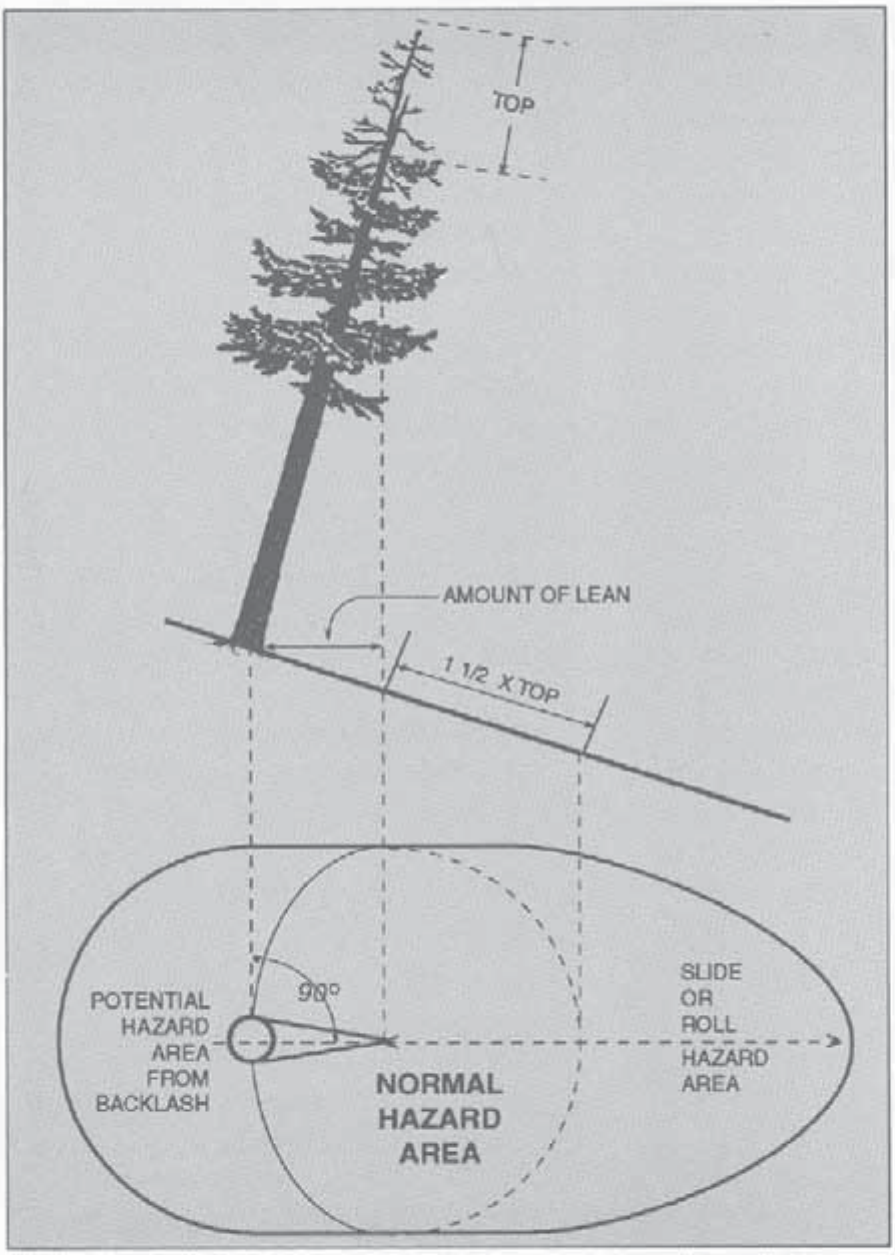


Fig. 7. — Hazard area for a Type 3 tree with lean.

Level or sloped ground ... lean in any direction (Fig. 7).

Step 1. Determine the length of the top or portion that would dislodge and add one half of its length.

Step 2. Determine the amount of lean (horizontal distance from where the top or portion would dislodge relative to the base).

Step 3. The hazard area would be the distance determined by adding steps 1 and 2 and 90 degrees on each side of the lean beginning at the base.*

The area behind the lean is not a hazard area unless equipment, yarding activity or falling timber contacts the reserve tree. Striking a Type 3 reserve tree could force a backlash opposite the lean, creating an additional hazard during the time of impact.

**On sloped ground where the dislodged section may roll downhill, the hazard area must be extended on the downhill side for whatever distance is necessary to protect workers.*

Reserve tree selection guidelines

Reserve tree types and hazard areas

1995

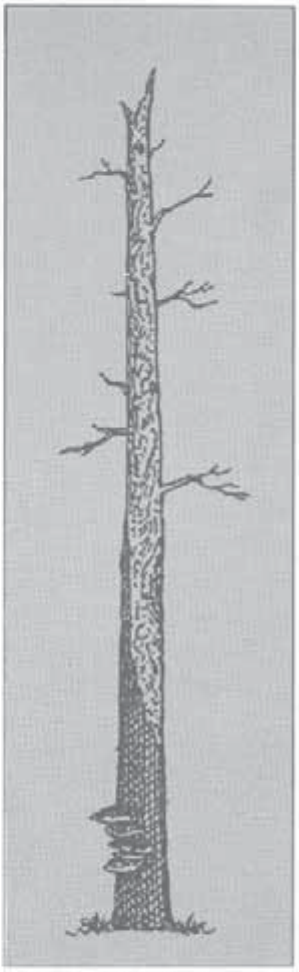


Fig. 8. — Reserve tree Type 4.

Type 4 reserve trees are live or dead with unstable trunk or roots, with or without bark. This includes "soft" snags as well as live trees with unstable roots caused by root rot or fire. They are considered the most dangerous type (Fig. 8).

Unexpected collapse could occur from any portion of the roots or trunk. Testing the snag at breast height will not give an accurate indication of the tree's condition higher up where failures can occur.

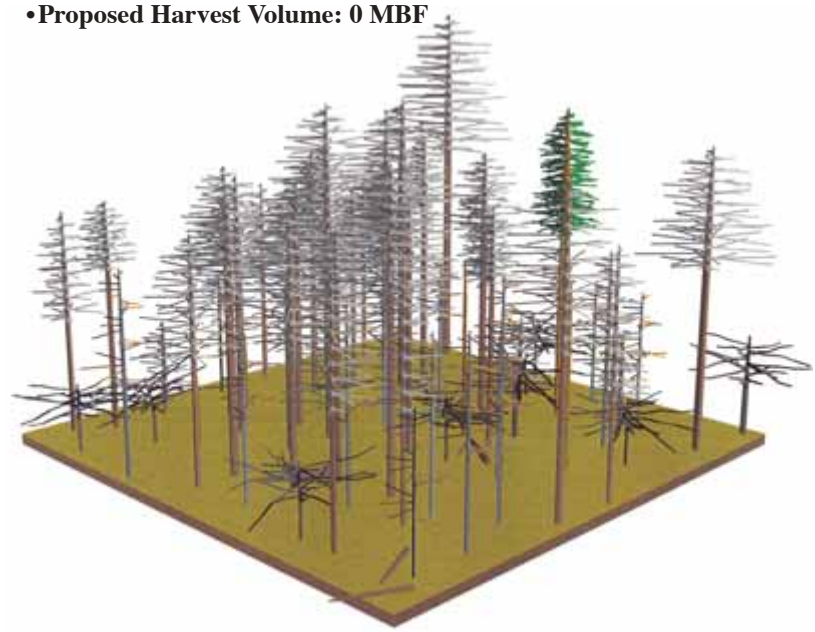
The hazard area for a Type 4 reserve tree is defined as the area on the ground that could be reached by any portion of the tree that may collapse.

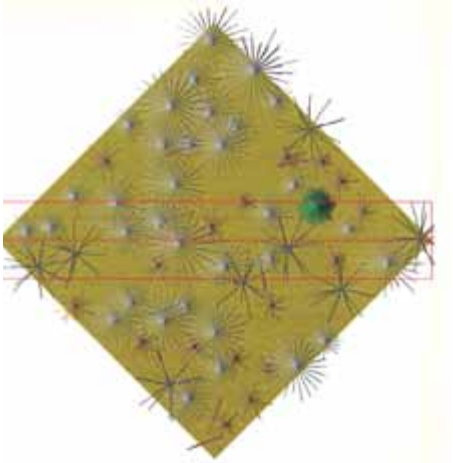
In determining the hazard area, the following criteria must be evaluated:

- Slope of the ground.
- Direction of lean.
- Height of the tree.

Figure D-2. Stand Visualization System (SVS) Representation of Proposed Salvage in Unit T32S, R1E, Section 29: Alternatives A, B, and F - No Salvage

Alternative A, B - No Salvage
Alternative F - No Salvage in Unit
- **Total Unit: 82 Acres**
- **Proposed Salvage: 0 Acres**
- **Total Unit Volume: 2,313 MBF**
- **Proposed Harvest Volume: 0 MBF**





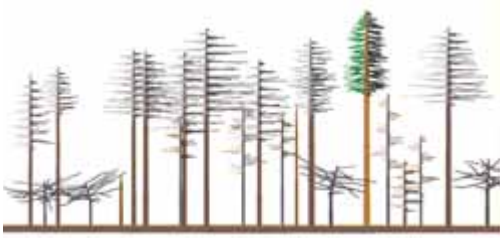
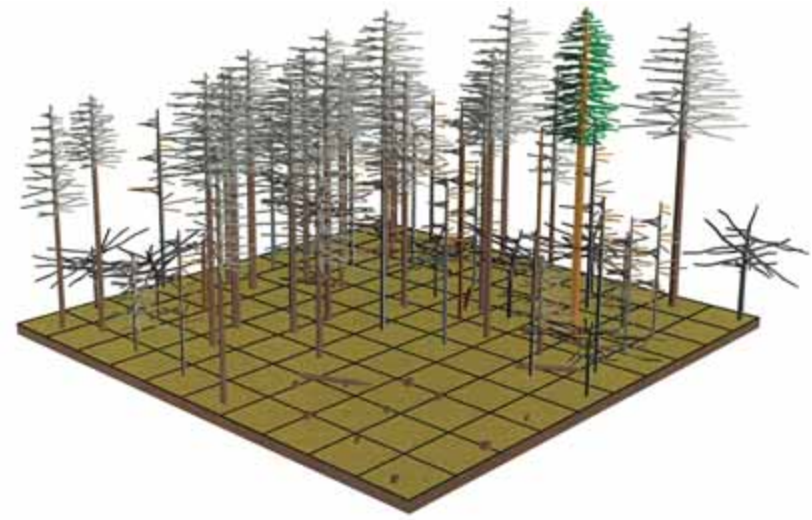
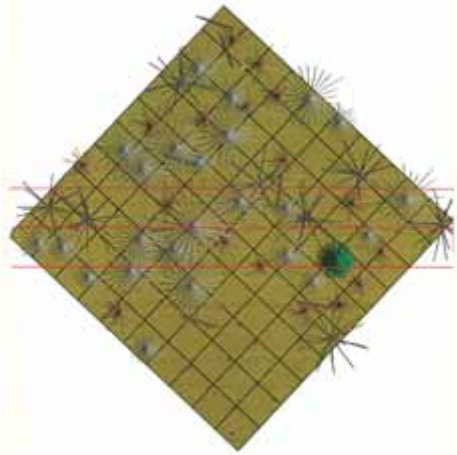


Figure D-3. SVS Representation of Proposed Salvage in Unit T32S, R1E, Section 29: Alternative C - South Cascades LSRA Criteria

- **Total Unit: 82 Acres**
- **Proposed Salvage: 16 Acres**
- **Total Unit Volume: 2,313 MBF**
- **Proposed Harvest Volume: 463 MBF**
- **Retains minimum 29 snags/acre concentrated in reserve acres**
- **Snags greater than 14" DBH**
- **Salvage limited to 20% of unit acres**





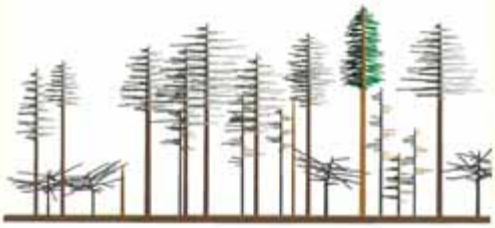
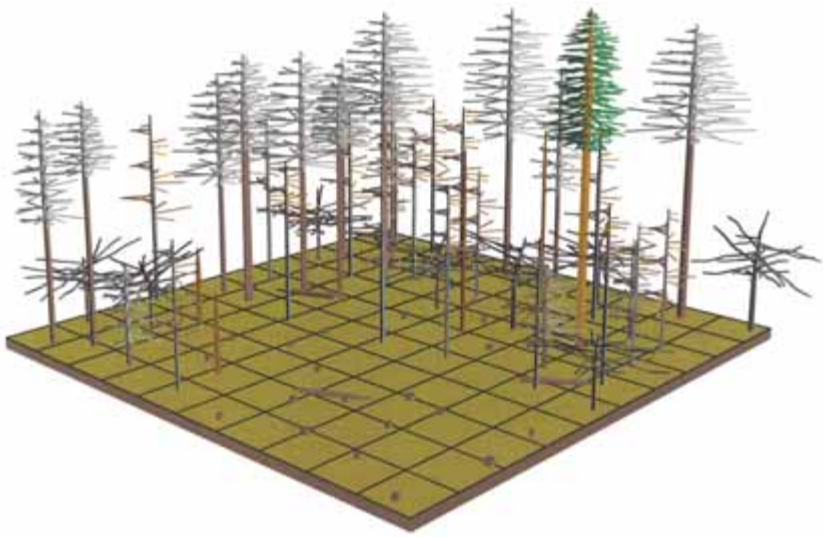
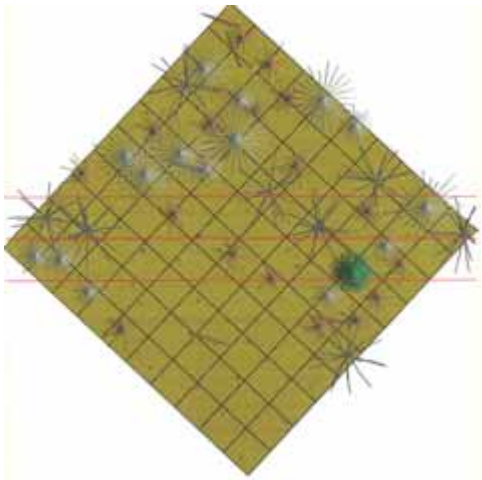


Figure D-4. SVS Representation of Proposed Salvage in Unit T32S, R1E, Section 29: Alternative D - LSR Salvage using DecAID

- **Total Unit: 82 Acres**
- **Proposed Salvage: 48 Acres**
- **Total Unit Volume: 2,313 MBF**
- **Proposed Harvest Volume: 1,388 MBF**
- **Retains minimum 26 snags/acre concentrated in reserve acres**
- **Snags greater than 10" DBH**





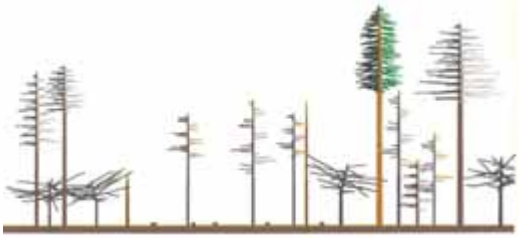
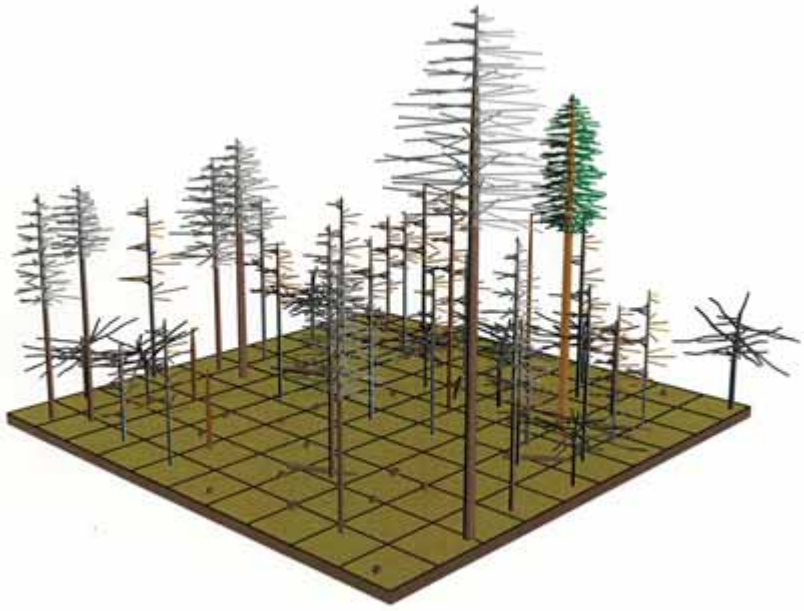


Figure D-5. SVS Representation of Proposed Salvage in Unit T32S, R1E, Section 29: Alternative E - High Level of Salvage

- **Total Unit: 82 Acres**
- **Proposed Salvage: 48 Acres**
- **Total Unit Volume: 2,313 MBF**
- **Proposed Harvest Volume: 1,176 MBF**
- **Leave 8 tpa greater than 14" DBH**



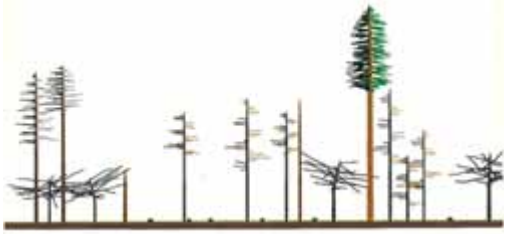


Figure D-6. SVS Representation of Proposed Salvage in Unit T32S, R1E, Section 29: Alternative G - Intensive Salvage Research Unit

- **Total Unit: 57 Acres**
- **Proposed Salvage: 57 Acres**
- **Total Unit Volume: 1,608 MBF**
- **Proposed Harvest Volume: 1,279 MBF**
- **Leave 6 tpa greater than 20" DBH**
- **100% salvaged**

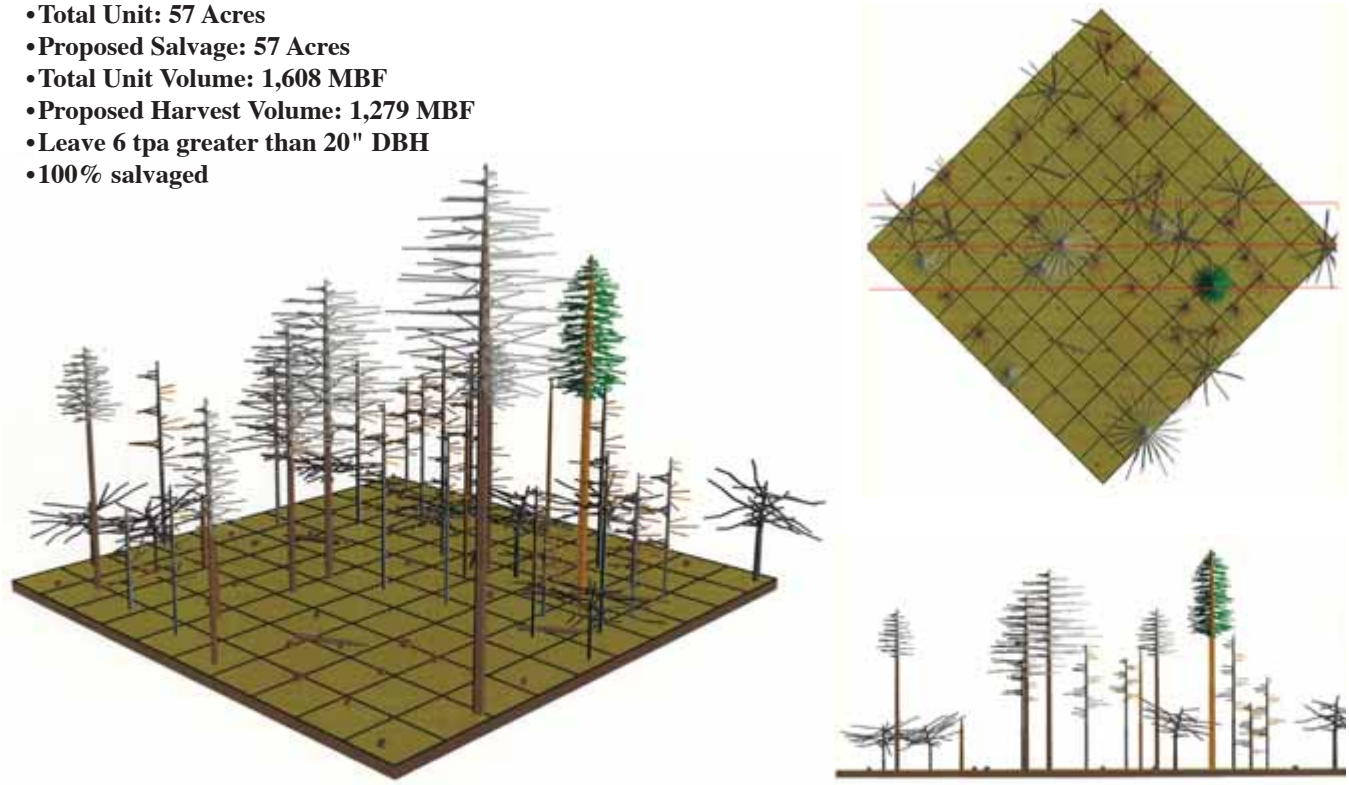


Figure D-7. SVS Representation of Proposed Salvage in Unit T32S, R1E, Section 29: Alternative G - Moderate Salvage Research Unit

- **Total Unit: 57 Acres**
- **Proposed Salvage: 40 Acres**
- **Total Unit Volume: 1,608 MBF**
- **Proposed Harvest Volume: 981 MBF**
- **Leave 6 tpa greater than 20" DBH**
- **30%unsalvaged; 70% salvaged**

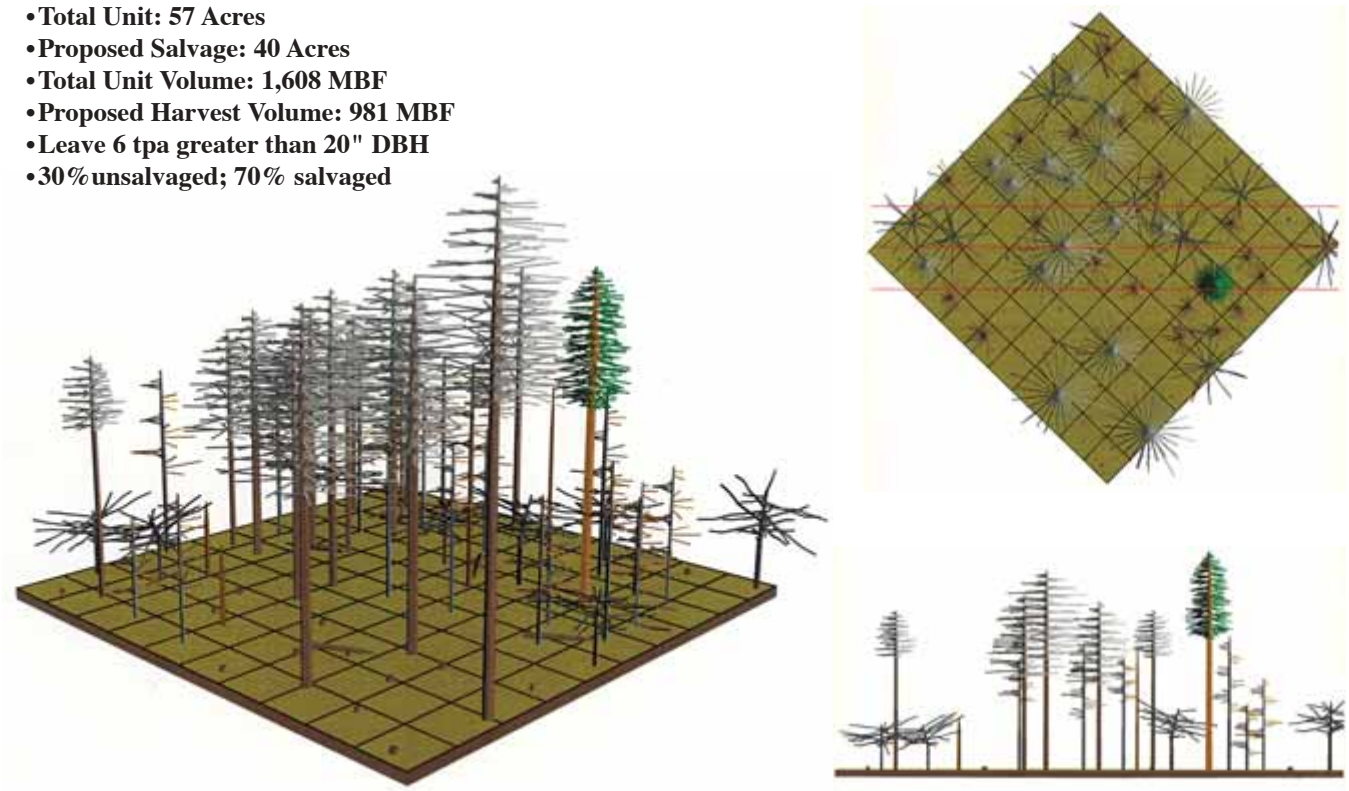
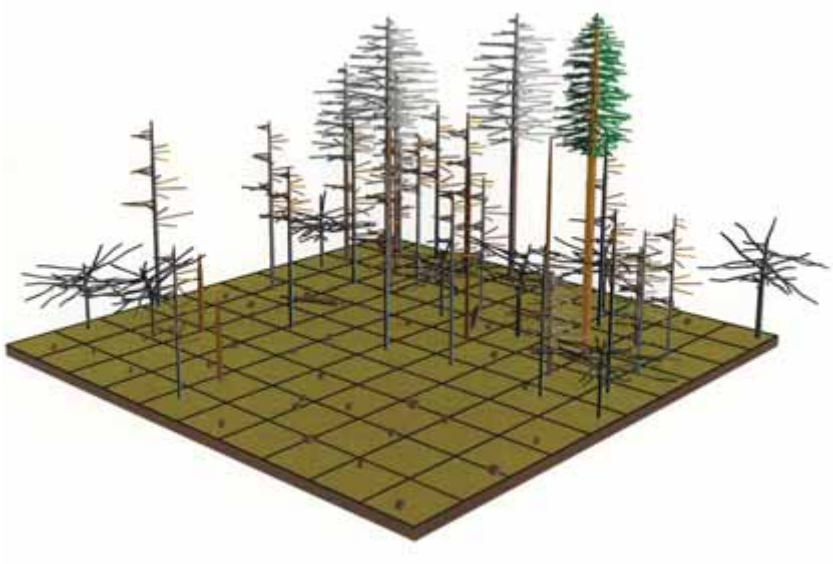
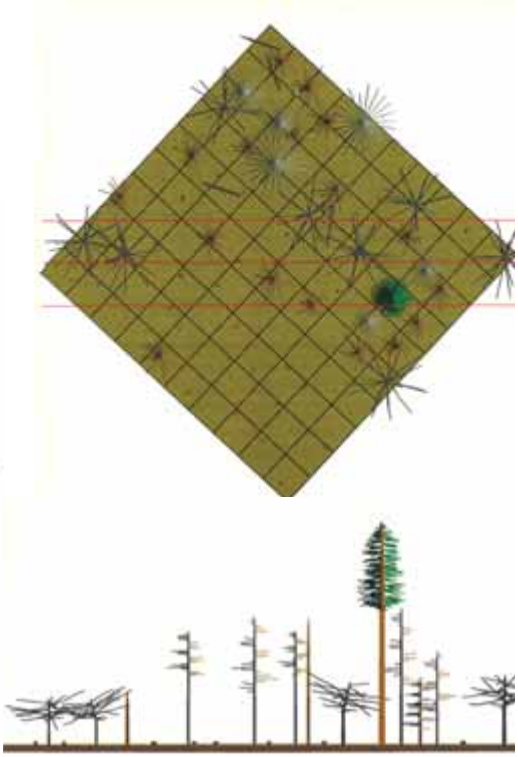


Figure D-8. SVS Representation of Proposed Salvage in Unit T32S, R1E, Section 29: Alternative G - Remaining Area Salvage

- **Total Unit: 57 Acres**
- **Proposed Salvage: 46 Acres**
- **Total Unit Volume: 1,607 MBF**
- **Proposed Harvest Volume: 1,297 MBF**
- **Snags greater than 16" DBH**
- **Retains minimum 8 snags/acre concentrated in reserve acres**





Appendix E
Proposed Restoration Projects

Proposed Restoration Project: Fishery Habitat Enhancement (see Map 2-1 and Table E-1)

Project Objectives

To improve habitat complexity and passage on BLM-administered land for salmon and trout, to mitigate any adverse effects from erosion, and to improve shade and future large wood recruitment in the first 160' from the stream.

Desired Future Conditions

Improved passage through culverts; logs almost parallel to the stream; rock weirs and logs to provide spawning gravel retention and rearing habitat; and trees reestablished in the Riparian Reserve to improve shade and future large wood recruitment to the stream.

Project Design Features

Replacement of four culverts for trout and potential coho passage would open five miles of habitat. The use of rock weirs would aid in collecting gravels for spawning and create plunge pools for rearing. Rock weirs would vary from 3 weirs per mile to 10 weirs per mile. Up to 40 cubic yards of gravel would be placed above rock weirs where possible.

Where accessible, large wood (20-24" DBH) would be placed almost parallel to the streambank for adult holding cover. Log placement would vary from 15 logs per mile to 25 logs per mile. Smaller diameter trees would be taken from riparian reserve thinnings and added to the stream where appropriate. As part of the riparian thinning restoration plan, trees 10 to 80 years old would be felled within 160' of the stream for instream habitat, provided 50 percent canopy is retained. Fifteen logs per mile is based on the Klamath Province and twenty-five logs per mile is based on a mix of Klamath and Cascade Province recommendations (Shatford 2002, 23-24).

Smaller diameter trees would be taken from Riparian Reserve thinnings and added to the stream where appropriate. As part of the riparian thinning restoration plan, trees 10 to 80 years old would be thinned from 30-160 feet from stream channel, provided at least 40 percent canopy cover is retained.

Instream projects would include the use of an excavator. Any temporary skid trails needed to access the stream would be water-barred and seeded. The excavator would make a 12-foot wide path from the road to the stream, with no more than ten passes on the path. No blading on the path would occur. Other resources in conflict with the designated sites would be mitigated with a buffer. Equipment would avoid archeological and botanical sites. West Branch Elk Creek includes existing logs from the fire with little supplementation needed of off-site logs. Equipment would avoid archeological and botanical sites.

Table E-1. Fishery Habitat Projects

Alternative	Project	Location	Miles Treated	Cost
B-G	**Culvert Replacement**	West Branch Elk Creek	4	$400,000
	Rock Weirs			
E	10 per mile	Sugarpine Creek	1.7	$42,500
E		Hawk Creek	1.1	$27,500
E		Timber Creek	1.0	$25,000
E		Flat Creek	0.8	$20,000
C, D, G	5 per mile	Sugarpine Creek	1.7	$21,500
C, D, G		Hawk Creek	1.1	$13,750
C, D, G		Timber Creek	1.0	$12,500
C, D, G		Flat Creek	0.8	$10,000
B, F	3 per mile	Sugarpine Creek	1.7	$12,750
B, F		Hawk Creek	1.1	$8,250
B, F		Timber Creek	1.0	$7,500
B, F		Flat Creek	0.8	$6,000
	Instream Logs			
E, F	25 per mile	Sugarpine Creek	1.7	$42,500
E, F		Hawk Creek	1.1	$27,500
E, F		Timber Creek	1.0	$25,000
E, F		Flat Creek	0.8	$20,000
E, F		West Branch Elk Creek	0.5	$12,500
C, D, G	20 per mile	Sugarpine Creek	1.7	$34,000
C, D, G		Hawk Creek	1.1	$22,000
C, D, G		Timber Creek	1.0	$20,000
C, D, G		Flat Creek	0.8	$16,000
C, D, G		West Branch Elk Creek	0.5	$10,000
B	15 per mile	Sugarpine Creek	1.7	$25,500
B		Hawk Creek	1.1	$16,500
B		Timber Creek	1.0	$15,000
B		Flat Creek	0.8	$12,000
B		West Branch Elk Creek	0.5	$7,500
	Gravel			
E, G	10 weirs per mile	39 yd^3 per weir	4.6	$90,000
C, D	5 weirs per mile	39 yd^3 per weir	4.6	$45,000
B	3 weirs per mile	39 yd^3 per weir	4.6	$27,000

NOTE: No projects are proposed in Alternative A.

Proposed Restoration Project: Late-Successional Forest Habitat Restoration (see Map 2-2 and Table E-2)

Project Objectives

Accelerate the growth of trees in stands to promote late-successional conditions with a variety of size classes. Maintain species diversity to promote connectivity between owl activity sites and develop late-successional forest characteristics.

Desired Future Conditions

Suitable spotted owl habitat for nesting, roosting, and foraging composed of mature timber stands. Stands contain large conifers (21" DBH or greater), multi-layered structure, and 60 percent or greater canopy closure (USDA and USDI 2001, I-2, 3). Understory should be open between shrub layer and mid-canopy for flight paths. Nest sites include cavities 50 or more feet above the ground in large decadent old growth conifers, large mistletoe clumps, old raptor nests, and platforms formed by whorls of large branches.

Project Design Features

Stands of trees less than 8" DBH (10-29 years old) would be pre-commercially thinned (PCT) to accelerate the growth of reserve trees. Stands of trees greater than 8" DBH (30-80 years old) would be commercially thinned to increase growth on residual trees, retain and promote large branches on select trees, promote the development of variable tree sizes in the residual stand, and retain the variety of species present.

Condition 1: Young conifer plantations generally 10 to 30 years old.

These stands are comprised of conifers of similar size. Thin conifers to a spacing range of 12-15' to increase growth rates, yet allow for crown closure within 10-20 years. This would promote natural shading, mortality, and removal of lower limbs. Retain unthinnned patches up to one-half acre in size for every 10 acres thinned. Retain up to 25 percent canopy component in hardwoods. Select up to 25 trees per acre and remove all surrounding vegetation for approximately 5' beyond the dripline. This would increase growth rates and retain limbs to allow for future large branches as these trees mature and become dominant in the overstory. Pile and burn slash from operations.

Condition 2: Young stands with mixed age and size classes, scattered overstory conifers.

These stands also have variable densities of conifers and hardwoods. In areas where predominant conifer size is less than 3" DBH, thin to a spacing of 12-15'. Areas where the predominant conifer size is 3-8" DBH, thin to a spacing of 15-20'. Retain unthinnned patches up to one-half acre in size for every 10 acres thinned. Retain hardwood trees unless they constitute greater than 25 percent of the canopy. Reduce hardwood component to 25 percent of canopy in stand being treated. Pile and burn slash from operations.

Condition 3: Stands dominated by conifers in age classes from 30 to 80 years old.

Conifer and hardwood densities and size classes are variable. Stands would be thinned to a basal area range of 120-140 feet per acre of total overstory basal area, retaining a minimum of 50 percent canopy closure in stand. Retain unthinnned patches up to one-half acre in size for every 10 acres thinned. Retain up to 25 percent of canopy component in hardwoods. Reserve trees would be a mix of species present. Variable spacing and reserving both dominant and codominant tree sizes is preferred over even-spacing and even-size distribution of reserve trees. Pile and burn slash from operations.

Table E-2. Late-Successional Forest Habitat Restoration Projects

Alternative	Acres		Condition Class Treatment (see Project Design Features above)	Costs	
	Pre-Commercial	Commercial		Pile and Burn	Thin
B	1,102	0	Conditions 1 and 2. PCT stands <8" DBH and >40% canopy closure.	$661,200	$198,360
				Total	
				$859,560	
C, G	862	466	Conditions 1, 2, 3. PCT and commercially thin stands 10-80 years old and >70% canopy closure. Commercial harvest only trees in excess of LSRA CWD retention level (5% ground cover or ~28 tpa, 70+ years old).	$796,800	$229,720
				Total	
				$1,026,520	
D	862	466	Conditions 1, 2, 3. PCT and commercially thin stands 10-80 years old and >70% canopy closure. Commercial harvest only trees in excess of DecAID CWD retention level (2% ground cover in 10-19" stands or ~17 tpa, 15" DBH by 60' high).	$796,800	$229,720
				Total	
				$1,026,520	
E	1,102	876	Conditions 1, 2, 3. PCT and commercially thin stands 10-80 years old and >40% canopy closure. Commercial harvest only trees in excess of DecAID CWD retention level (2% ground cover in 10-19" stands or ~17 tpa, 15" DBH by 60' high).	$1,186,800	$338,520
				Total	
				$1,525,320	
A, F	No Projects Proposed.				

NOTE: PCT costs range from $160 to $200 per acre. $180 per acre used for PCT cost estimate.
Commercial thin cost estimate used is $160 per acre.
Piling and burning costs range from $400 to $800 per acre. $600 per acre used for cost estimate.

Proposed Restoration Project: Pine Habitat Restoration (see Map 2-2 and Table E-3)

Project Objectives

Promote pine species regeneration in areas historically inhabited by pines, retaining existing dominant pine in the overstory. Promote pine dominance in stands historically dominated by pines but presently dominated by Douglas-fir and other species.

Desired Future Conditions

Ponderosa and sugar pines dominant in the overstory up to 23 trees per acre (tpa) with a codominant component of pines (<20" DBH) up to 40 tpa. An understory of conifers dominated by pines (<12" DBH) with less than 80 tpa (USDA and USDI 1998, 179). Mix of conifers in the overstory, including Douglas-fir and incense cedar and a component of hardwoods in mid-canopy and understory including madrone and chinquapin.

Project Design Features

Stands with ponderosa or sugar pine present in overstory or understory, or historic presence of pine in overstory would be thinned to promote pine retention and growth. Large overstory pines would have non-pine vegetation in understory removed to promote pine regeneration. Stands with pine less than 80 years old would be thinned to retain pine and promote growth of existing pine in stand.

- **Stands with large (>20" DBH and >80 years old) overstory ponderosa or sugar pines present.**
  In areas where pine are not present in the understory, clear around large (>24" DBH) overstory pines for up to 20' beyond dripline to promote pine regeneration. Trees up to 24" may be removed (USDA and USDI 1998, 165). When large overstory trees are within 50' of each other, only one of those trees would receive understory clearing.

  Beyond the clearing area, pre-commercial thin (14-20 foot spacing) understory stands (<8" DBH) presently consisting of Douglas-fir, white fir, incense cedar, ponderosa and sugar pine, madrone, and chinquapin to favor dominance of pine species as residual stand.

  Beyond the clearing area, commercial thin understory stands (>8" DBH) retaining 100-180 square feet of total basal area retaining the same species preference for pine. Only trees less than 80 years old would be removed. These would generally be less than 18" DBH.

- **Stands with sugar and ponderosa pines present in overstory predominantly less than 18" DBH (30-80 years old).**
  Commercial thin these stands favoring all healthy pines for reserve trees retaining 100-180 square feet of total basal area (USDA and USDI 1998, 190).

- **Young stands less than 8" DBH with pine present and without pine in the overstory, but with historic presence of pine in the overstory.**
  Pre-commercial thin (14-20 foot spacing) stands presently consisting of Douglas-fir, white fir, incense cedar, ponderosa and sugar pine, madrone, and chinquapin to favor dominance of pine species as residual stand. Retain unthinnned patches up to ½ acre in size for every 10 acres thinned

Introduce prescribed fire into the understory after reducing initial fuel loadings through piling and burning of piles.

Table E-3. Proposed Pine Habitat Restoration

Alternative	Acres	Description	Cost
B	156	PCT stands with pine <10-30 years old; <8" DBH; >10% canopy. 14-20' spacing.	$121,680
C, D, G	793	PCT pine stands 10-30 years old; <8" DBH; >10% canopy. 14-20' spacing (16 acres). Commercial thin stands 30-80 years old; >8" DBH; >40% canopy closure (91 acres). Clear around pines >24" DBH and commercial thin stands >80 years old (686 acres).	$447,600
E	2,005	PCT pine stands 10-30 years old; <8" DBH; >10% canopy. 14-20' spacing (156 acres). Commercial thin stands 30-80 years old; >8" DBH; >10% canopy closure (162 acres). Clear around pines >24" DBH and commercial thin stands >80 years old (1,687 acres).	$1,471,280
A, F	None.		$0

NOTE: Costs used are $160 per acre for commercial thinning and clearing around pine, and $400 per acre for piling and burning.
Costs used are $180 per acre for PCT treatment and clearing around pine, and $600 per acre for piling and burning.

Proposed Restoration Project: Riparian Reserve Thinning (see Map 2-2 and Table E-4)

Project Objectives

Improve the habitat and functioning of Riparian Reserves for late-successional dependent terrestrial and aquatic organisms. Accelerate the growth rates and size variability of residual trees in the existing stands and maintain species diversity.

Desired Future Conditions

Functioning riparian area that allows for late-successional species movement and stream protection, and maintains species composition and characteristics needed to attain Aquatic Conservation Strategy. Attain 75 percent late seral vegetation in riparian areas. Riparian vegetation would be dominated by large (>24" DBH) conifers with a diverse species composition including riparian hardwoods and mixed conifer species. Conifer species of preference would be Douglas-fir, incense cedar, and pacific yew, with western hemlock and white fir in the upper elevations (above 3,500') and ponderosa and sugar pines in the lower elevations (below 3,000'), particularly on south exposures. Hardwood species to favor include alder, big leaf maple, and Oregon ash. Canopy closures would generally be greater than 70 percent. The stand would be able to supply amounts and distributions of coarse woody debris sufficient to sustain physical stability and complexity (USDI 1995, 22).

Project Design Features

Stands of trees less than 8" DBH (10-30 years old) within Riparian Reserves would be pre-commercially thinned to accelerate the growth of residual trees. Retain unthinnned patches up to one-half acre in size for every ten acres thinned. Stands of trees greater than 8" DBH (30-80 years old) would have up to 12 dominant tpa selected and competing trees with crowns touching would be felled or girdled. This would be done to increase growth of residual trees, promote large branches on select trees, and develop the recruitment of large woody material for streams. Felling and girdling would occur on trees less than 20" DBH. Thinning would be performed on an irregular spacing with reserve trees selected to aid in the development of future stand characteristics such as variable spacing, multistory canopies, large limbs, and canopy gaps (USFS 2000). Pile and burn slash from treatments in stands <8" DBH. Leave a no-cut buffer zone 50' from streams containing coho salmon and 30' from all other streams.

Table E-4. Riparian Reserve Thinning

Alternative	Acres		Treatment	Costs	
	<8" DBH	> 8" DBH		Pile and Burn	Thin
B	117	0	Perennial streams only.	$70,200	$21,060
			PCT stands <8" DBH and >40% canopy closure. Conifers spaced 14-20'; 110 to 220 tpa. In areas <110 tpa, clear shrubs touching conifers. Pile and burn slash.	**Total**	
			In stands with variable age and size classes, conifers >8" DBH are preferred for leave, provided they are not suppressed remnants from a harvested stand with <20% crown ratios.	**$91,260**	
			Retain species mix and favor minor species for leave.		
			Release up to 25 conifers per acre; clear all vegetation within 5' radius of dripline of leave trees.		
			Retain hardwoods, except within dripline of leave trees.		

Table E-4. Riparian Reserve Thinning

Alternative	Acres		Treatment	Costs	
	<8" DBH	> 8" DBH		Pile and Burn	Thin
C, G	225	134	Perennial streams only. PCT stands <8" DBH and >40% and <40% canopy closure. Conifers spaced 14-20'; 110 to 220 tpa. In areas <110 tpa, clear shrubs touching conifers. Pile and burn slash. In stands with variable age and size classes, conifers >8" DBH are preferred for leave, provided they are not suppressed remnants from a harvested stand with <20% crown ratios. Retain species mix and favor minor species for leave. Release up to 25 conifers per acre; clear all vegetation with 5' radius of dripline of leave trees. Retain hardwoods, except within dripline of leave trees. Thin in stands between 8" and 20" DBH and >40% and <40% canopy closure. Select 12 dominant tpa spaced ≈60'. Fall or girdle only the trees with crowns touching the selected leave trees. Maintain 5% ground cover (28 tpa, 70+ years old) in CWD. Felled trees remain on site or placed in stream for CWD. If felled trees >20 tons per acre (25, 16" DBH trees), girdle non-reserved trees.	$215,400	$67,300
				Total	
				$282,700	
D	225	134	Perennial streams only. PCT stands <8" DBH and >40% and <40% canopy closure. Conifers spaced 14'-20'; 110 to 220 tpa. In areas <110 tpa, clear shrubs touching conifers. Pile and burn slash. In stands with variable age and size classes, conifers >8" DBH are preferred for leave, provided they are not suppressed remnants from a harvested stand with <20% crown ratios. Retain species mix and favor minor species for leave. Release up to 25 conifers per acre; clear all vegetation with 5' radius of dripline of leave trees. Retain hardwoods, except within dripline of leave trees. Thin in stands between 8" and 20" DBH and >40% and <40% canopy closure. Select 12 dominant tpa spaced ≈60'. Fall or girdle only the trees with crowns touching the selected leave trees. Felled trees remain on site for CWD. CWD level from DecAID; 4.8% ground cover (≈40 tpa, 15" DBH or ≈24 tpa, 20" DBH).If felled trees >20 tons per acre (25, 16" DBH trees), girdle non-reserved trees.	$215,400	$67,300
				Total	
				$282,700	

Table E-4. Riparian Reserve Thinning

Alternative	Acres		Treatment	Costs	
	<8" DBH	> 8" DBH		Pile and Burn	Thin
E	437	613	All streams. PCT stands <8" DBH and >40% and <40% canopy closure. Conifers spaced 14-20'; 110 to 220 tpa. In areas <110 tpa, clear shrubs touching selected conifers. Pile and burn slash. In stands with variable age and size classes, conifers >8" DBH are preferred for leave, provided they are not suppressed remnants from a harvested stand with <20% crown ratios. Retain species mix and favor minor species for leave. Release up to 25 conifers per acre; clear all vegetation with 5' radius of dripline of leave trees. Retain hardwoods, except within dripline of leave trees. Thin in stands between 8" and 20" DBH and >40% and <40% canopy closure. Leave 160 ft^2 basal area per acre. Retain minimum 60% canopy closure. 15-25' spacing for leave conifers. Variable spacing, reserving both dominant and codominant trees, is preferred. Felled trees remain on site for CWD. CWD level from DecAID; 4.8% ground cover (≈40 tpa, 15" DBH or ≈24 tpa, 20" DBH). If felled trees >20 tons per acre (25, 16" DBH trees), girdle non-reserved trees.	$630,000	$201,260
				Total	
				$831,260	
A, F	No Projects Proposed.				

NOTE: PCT costs range from $160 to $200 per acre. $180 per acre used for cost estimate.
Thinning and girdling costs range from $150 to $250 per acre. $200 per acre used for cost estimate.
Piling and burning costs range from $400 to $800 per acre. $600 per acre used for cost estimate.

Proposed Restoration Project: Oak Woodland and Meadow Restoration (see Map 2-3 and Table E-5)

Project Objectives

Maintain or enhance oak woodland and meadow values for wildlife, range, plants, and biological diversity. Protect and improve special habitats within the Elk Creek Watershed.

Desired Future Conditions

Oak woodlands in an open condition that favors large oaks and pines and a diversity of native grasses, forbs, and shrubs and also provides for future regeneration of oaks and pines. Meadows would be in an open condition with healthy native grasses and forbs.

Project Design Features

Management activities could include manually thinning small-diameter white oak; removing competing conifers; clearing around large, healthy pine; manually cutting, piling, and burning older brush patches; and applying frequent low-intensity prescribed fire. Meadow openings would be maintained by removing Douglas-fir and incense cedar from around the edges of meadows.

Inside the fire perimeter, sites would be monitored and treatment applied when vegetative conditions warrant (in 5-15 years). Those conditions are:

- Numerous small conifer seedlings reappearing on a site.
- Large amounts of brush seedlings reoccupying the site.
- Oak resprouting or oak seedlings reoccupying the site.

Outside the fire perimeter, site-specific treatment would include the following:

- Manually thinning small-diameter white oak.
- Manually thinning small competing conifers.
- Clearing around large, healthy pine.
- Manually cutting, piling and burning older brush patches.
- Applying low-intensity fire.
- Stagger treatments over several years so areas are treated at different times and oak woodlands are in different successional stages across the landscape. Treatments would not begin until at least 2004.

Prescribed fire would be applied under conditions when a low intensity, short-duration fire would occur. Heat flame-length would average 3 feet or less. Fires would need to be prescribed while reestablishing vegetation is small enough to be susceptible to the low flame lengths. Some manual slashing of woody vegetation may be required prior to burning in order to meet resource objectives.

Table E-5. Oak Woodlands and Meadow Restoration

Alternative	Legal Description	Acres	Cost
A	No Projects		
C,D,E,F,G	T32S, R1E, Sec. 29	56	$11,200
C,D,E,F,G	T33S, R1E, Sec. 3	123	$24,600
C,D,E,F,G	T33S, R1E, Sec. 7	34	$6,800
C,D,E,F,G	T33S, R1E, Sec. 9	27	$5,400
C,D,E,F,G	T33S, R1E, Sec. 10	176	$35,200
C,D,E,F,G	T33S, R1E, Sec. 15	97	$19,400
C,D,E,F.G	T33S, R1E, Sec. 17	6	$1,200
C,D,E,F,G	T33S, R1W, Sec. 1	36	$7,200
B,C,D,E,G	T32S, R1E, Sec. 27	30	$6,000
B,C,D,E,G	T32S, R2E, Sec. 29	12	$2,400
B,C,D,E,G	T32S, R2E, Sec. 31	102	$20,400
B,C,D,E,G	T32S, R2E, Sec. 32	14	$2,800
B,C,D,E,G	T33S, R1E, Sec. 17	21	$4,200
B,C,D,E,G	T33S, R1E, Sec. 19	510	$102,000
B,C,D,E,G	T33S, R1E, Sec. 21	182	$36,400
B,C,D,E,G	T33S, R1E, Sec. 30	133	$26,600

Proposed Restoration Project: Reforestation (see Map 2-4 and Table E-6)

Project Objectives

Reforest areas that supported forest vegetation before the fire. Plant areas with species representative of the plant series existing in those forest stands. Place a stand on a pathway toward a mixed conifer forest that can, more quickly, obtain the attributes of a late-successional forest than would occur naturally.

Desired Future Conditions

Mixed conifer stands at age 20 with a minimum of 70 percent canopy closure and a hardwood component of up to 25 percent of canopy. Retain a residual level of remnant overstory trees, snags, and coarse woody debris as described in stand advisories for late-successional habitat or the LSRA. This is an interim stage. The final condition for stands in this watershed is described in the proposed Late-Successional Forest Habitat Restoration project.

Project Design Features

Areas burned at high or moderate severity levels would be planted with tree seedlings to a species mix consistent with those species present in those locations before the fire. Priority for planting would be in past plantations, areas with slopes greater than 65 percent, riparian areas, and remaining areas of high or moderate burn intensity, including spotted owl activity centers.

Table E-6. Tree Planting within the Fire Perimeter

Alternatives	Acres	Spacing	Description	Areas to Avoid	Cost
A, E	6,000	Follow ESRP guidelines. 10'x10' spacing; 430 trees per acre (tpa).	Species mix of conifers (Douglas-fir, sugar and ponderosa pines, incense cedar). Plant hardwoods (i.e., alder and maple) and conifers in riparian areas.	No planting in patches <5 acres.	$600,000
B	3,016	10'x10' spacing with microsite emphasis; 430 tpa. No mulching, tubing, and shading unless replanting. Replant if seedling survival is <100 tpa.	Remove vegetation around 50% of seedlings. Species mix of conifers (Douglas-fir, sugar and ponderosa pines, incense cedar, white fir). Plant hardwoods (i.e., alder and maple) and conifers in riparian areas. Add hemlock in riparian areas above 3,500' elevation	No planting in low burn severity areas; oak woodlands; patches <10 acres.	$301,600
C, D, G	2,152	10'x10' spacing with microsite emphasis; 430 tpa. No mulching, tubing, and shading unless replanting. Replant if seedling survival is < 100 tpa.	Remove vegetation around 50% of seedlings if density is >250 tpa. Remove vegetation around all seedlings if density is <250 tpa. Species mix of conifers (Douglas-fir, sugar and ponderosa pines, incense cedar, white fir). Plant hardwoods (i.e., alder and maple) and conifers in riparian areas. Add hemlock in riparian areas above 3,500' elevation.	No planting in low burn severity areas; oak woodlands; patches <5 acres.	$215,200
F	1,045	10'x10'; 430 tpa. Reevaluate after 3 years. Replant if natural processes are not recovering.	Species mix of conifers (Douglas-fir, sugar and ponderosa pines, incense cedar, white fir). Plant hardwoods (i.e., alder and maple) and conifers in riparian areas. Add hemlock in riparian areas above 3,500' elevation.	Plant only in riparian areas and slopes >65%.	$104,500

NOTE: Average cost for tree planting in fire area is $100 per acre.

Proposed Reforestation Research Project (see Tables E-7 and E-8)

Project Objectives

To evaluate mixed-species reforestation plantings, to identify and characterize temporal patterns of vegetation structural development and species diversity, to assess temporal dynamics of fuels loading and fire risk, and to determine impacts of snag retention on survival and growth of planted trees.

For the initial phases of stand development, there are six specific research objectives to determine the effects of:

1. snag retention on the survival and establishment of planted seedlings by species,
2. planted seedling versus natural regeneration on tree survival and growth,
3. monoculture versus mixed-species plantings on planted seedling survival and growth,
4. planting density on survival and growth of planted seedlings by species, and site occupancy by planted and naturally regenerating trees, shrubs, and herbs,
5. weed control on planted seedling establishment and growth of trees, shrubs, and herbs, and
6. physiographic site conditions on planted seedling survival and growth of trees, shrubs, and herbs

Desired Future Conditions

Forest stands having a high degree of species and structural diversity (relative to monospecific plantations) in which Douglas-fir, white fir, and incense cedar contribute to the main overstory canopy as codominants; dispersed sugar pine and ponderosa pine having complex canopy structure and large diameter stems and branches as dominants; and sub-canopy hardwood trees providing structural continuity between understory shrubs and the overstory.

Project Design Features

This planting is a research project designed to provide a rigorous basis for evaluating the efficacy of snag retention, mixed-species plantings, variable planting density, and woody vegetation removal as means for regulating the development of biologically and structurally complex forest stands, and for varying the temporal dynamics of fuels profiles and fire risk.

Six species composition, planting density, and vegetation removal treatments (weeding) would be established:

1. Unplanted, woody vegetation not removed
2. Douglas-fir, planted at 435 tpa, woody vegetation removed
3. Mixed species planting, 435 tpa, woody vegetation removed
4. Mixed species planting, 435 tpa, woody vegetation not removed
5. Mixed species planting, 190 tpa, woody vegetation removed
6. Mixed species planting, 190 tpa, woody vegetation not removed

Woody vegetation removal on designated treatment plots will be completed manually prior to planting, in year 1 and in year 3; and in year 5 if necessary, following planting.

Species mixes will consist of the following:

- Sites 3500'+ elevation – Douglas-fir, 20%; White fir, 20%; sugar pine, 20%; incense cedar and ponderosa pine, 20%; hardwood sprouts (Pacific madrone and/or chinquapin oak) 20%.
- Sites <3500' elevation – Douglas-fir, 40%; sugar pine, 20%; incense cedar and ponderosa pine, 20%; hardwood sprouts (Pacific madrone and/or chinquapin oak) 20%.

Where specified, hardwood densities will be obtained by retaining hardwood sprouts, thinned to a single stem per clump, at the 20 percent proportion prescribed.

The treatments will be implemented on both unsalvaged and salvaged sites to evaluate effect of residual snags as microsite modifiers on seedling establishment. Some treatments will be replicated on moderate and harsh planting sites as defined predominantly by aspect (northerly vs. southerly), but also taking into account soil depth (shallow vs. deep) and slope

position (mid vs. upper).

A total of 56, 1.5-ac plots will be established and allocated by treatment condition as outlined in Table E-7 below.

Table E-7. Acreage Requirement by Treatment Condition for Experiments A-C, Combined

Composition	Density (tpa)	Weeding	Site Aspect	Salvage	Number of Plots	Minimum Acres
No planting	0	Not weeded	Southerly	No salvage	5	7.5
Douglas-fir	435	Weeded	Southerly	No salvage	5	7.5
Mixed-species	435	Weeded	Southerly	No salvage	6	9.0
Mixed-species	435	Not weeded	Southerly	No salvage	6	9.0
Mixed-species	190	Weeded	Southerly	No salvage	5	7.5
Mixed-species	190	Not weeded	Southerly	No salvage	5	7.5
Mixed-species	435	Weeded	Northerly	No salvage	6	9.0
Mixed-species	435	Not weeded	Northerly	No salvage	6	9.0
Mixed-species	435	Weeded	Southerly	No salvage	6	9.0
Mixed-species	435	Weeded	Southerly	Salvage	6	9.0
Total					56	84

Plots will be located, planted and treated in FY04 following salvage. Vegetation monitoring measurements (trees, shrubs, herbaceous) and fuels evaluations will be made in years 1, 2, 3, and 5 following planting. Annual reports will be delivered to the BLM with additional in-depth summaries and interpretations after the third and fifth growing seasons.

It is anticipated that these plots will be maintained and monitored for several decades to achieve project objectives. Beyond the fifth year, sampling frequency and reporting will be dictated by observed vegetation dynamics, continued BLM interest and support, and funding availability.

Cost Estimate:

Estimated costs for the study from Fiscal Year 2004 through 2009 are presented in Table E-8.

Table E-8. Cost Estimates by Activity and Year Assuming Measurement of Basic Response Variables

Fiscal Year	Costs (x $1,000)			Total
	Seedling Stock and Planting	Vegetation Control	Data Collection, Analysis, and Reporting	
2004	$13.2	10.8	54.5	$900
2005	3.6	7.2	63.9	$57,200
2006			101.8	0
2007		10.8	65.4	$60,800
2008			69.0	$35,000
2009		10.8	60.9	$60,800
Total	16.8	39.6	415.5	$320,500

Proposed Restoration Project: Fuel Management Zone (FMZs) (see Map 2-5 and Tables E-9 and E-10)

Project Objectives

Create FMZs to assist in future wildfire suppression activities, to provide for firefighter safety, and to provide anchor points for control lines. To meet the LSRA recommendation for breaking the watershed into 5,000- to 7,000-acre blocks. Construction of FMZs would also meet intent of National Fire Plan by providing protection to Communities at Risk and Wildland Urban Interface areas.

Desired Future Conditions

A series of FMZs on the ridgelines, on the perimeter and within the LSR. Anchor points for fire lines, burnout operations, and possible safety zones for firefighters. LSR divided by FMZs into blocks of 5,000- to 7,000-acres to reduce future fire size.

Project Design Features

Within the burn perimeter, stand replacement areas less than 10 acres would be salvaged to reduce fuel loadings and reduce spotting potential. Proposed units would be located within an identified FMZ and cover between 50-70 acres. A target of six snags per acre would be left standing on or near the ridge top. The preferred leave snags would be the shorter snags. The understory vegetation would be cut, piled, and burned.

In FMZs proposed in the unburned portion of the watershed, the understory conifers and hardwoods would be thinned and slash would be hand-piled. Hand-cutting, hand-piling, and burning of brush would occur. The majority of the conifers cut would be 6" DBH and less. In some cases, small diameter commercial conifers would be cut and removed as needed to reduce crown bulk density to a level that would not perpetuate crown fires. After ladder fuel loadings are reduced, an underburn would be conducted to further reduce ground fuels. This treatment would occur two to five years after the initial entry. A second underburn would occur 10-15 years later. At that time, initial treatment would be finished and any further treatments would be considered maintenance.

Removal of brush and sub-merchantable timber would be accomplished through hazardous fuel reductions contracts. Merchantable timber would be removed through a timber sale contract, where feasible. Approximately 35 acres located in T33S, R1W, Sections 14 and 15 would be proposed for commercial thinning.

The West Branch Fire of 1972, located in T32S, R2W, was reforested and pre-commercially thinned. This area burned again in the Timbered Rock Fire. Stand diameters range from 3-8 inches. Young conifers in this area killed in the Timbered Rock Fire would be cut, piled, and burned. This would aid in reforestation efforts and reduce fuel loads to help reduce future fire severity.

Table E-9. Proposed Fuel Management Zones

Alternative	FMZ Widths	Acres	Cost per Acre	Total Cost
A	No Projects.	0	0	0
B-E, G	200' within LSR; 400' outside LSR	1,300	$1,100	$1,430,000
F	200' within LSR; 200' outside LSR	500 within fire area	$1,100	$550,000

Table E-10. Fuel Treatment within old West Branch Fire

Alternative	Acres	Cost per Acre	Total Cost
A, F	0		0
B-E, G	70	$1,000	$70,000

Restoration Project: Owl Activity Center Underburns (see Map 2-5 and Table E-11)

Project Objectives

The short-term objective is to reintroduce fire to maintain existing reduced fuel loadings and current fuel profiles created by the Timbered Rock Fire, and to simulate the historic natural disturbance process. The long-term objective is to increase the resiliency of sites during future high intensity fire events by reducing fire severity while maintaining owl habitat in late-successional forest conditions.

Desired Future Conditions

Multi-storied stands with low ground fuel loadings. These stands would have a break in the ladder fuels from the ground to the overstory canopy layer.

Project Design Features

This action would capitalize on the natural fuel reduction created by the Timbered Rock Fire. The proposal calls for underburning when fuel moistures for the larger, 6-inch or greater (1000-hour) fuels are at a level too moist for total consumption. The primary carrier of the prescribed fire would be the 0 to 3-inch (1- to 100-hour) fuels, litter layer, and any small brush the fire would consume. These treatments are being proposed on a limited scale to demonstrate effectiveness and ability to meet prescription requirements. The units would be configured using logical topographic breaks and may include all or portions of the owl activity centers and some adjacent areas. In addition, some burning outside the activity centers would be proposed using logical topographic breaks. Burning would occur outside of nesting season.

Initial entry would be in the next 2-3 years or later, if site conditions warrant. The need for follow up treatments would be evaluated and treatment would be proposed when fuel buildups approach the mid- to high-range of Fuel Model 11, or prior to reaching the mid-range of Fuel Model 10 (see Appendix M for fuel model descriptions). The second treatment would occur in 5-10 years and further treatments would occur in the 10- to 20-year range. All treatments will be based on actual conditions and timeframes are approximate. Seasonal restrictions would be implemented to avoid disturbing spotted owl nesting activities.

Table E-11. Proposed Owl Activity Center Underburns

Alternative	Number of Sites	Number of Acres	Cost per Acre	Total Cost
A	0	0	0	0
B, C, D, E, G	4	425	$240	$102,000
F	3	300	$240	$72,000

Proposed Restoration Project: Eagle Habitat Improvement (see Map 2-6 and Table E-12)

Project Objectives

To promote growth and future development of large overstory trees into trees with large limbs or broken tops suitable for nesting eagles.

Desired Future Conditions

Scattered individuals and groups of large overstory ponderosa pine, sugar pine, and Douglas-fir trees with large limbs suitable for supporting eagle nests and with openings between branching whorls. The trees would have an open or broken canopy or would be located near the edge of the stand so the eagles would have an unrestricted flyway. Tall perch trees would be present at the edges of the stand. These nest stands would be located on the ridge between Lost Creek Lake and Elk Creek.

Project Design Features

Younger stands would be treated to promote growth of large overstory ponderosa pine, sugar pine, and Douglas-fir with large boles and thick limbs, strong enough to support the large stick nests built by bald eagles and golden eagles. Smaller trees around the meadow edges would be thinned. A residual conifer spacing of 12-20' would be implemented in stands less than 30 years old to promote the development of large trees with the desired habitat attributes, such as large limbs and whorls.

Stands with existing large overstory trees, treatments would improve the vigor of large overstory sugar pine, ponderosa pine, and Douglas-fir. Removing competing vegetation around selected trees would increase resistance to mortality from fire. Vegetation would be removed around the reserved large trees by clearing 10-15' out from the drip line of the pine. Co-dominant trees with crowns touching the selected trees would be removed unless the removal would harm reserve trees. Projects would be coordinated with proposed fuel management projects.

Two areas are proposed for treatment:

- T33S, R1E, Section 15 - Around the meadows in the north central part of the section and the NWSW part of the section. The project would occur along the west side of the meadow and extend 300 feet into the stand. Two areas extend outside the project boundary into the Lost Creek Watershed; approximately 200 feet in one area and 100 feet in the second area.
- T33S, R1E, Section 21 - Located within a proposed pine restoration project area. The project would occur along the north and west edge and extend 300 feet into the stand.

Table E-12. Eagle Nesting Habitat Projects

Alternatives	Location	Acres	Treatment	Costs
B-E, G	T33S, R1E, Sec. 15	30	Pre-commercial thinning; Pile and burn	$21,000
B-E, G	T33S, R1E, Sec. 21	20	Pile and burn	$10,000
A, F	No Projects			

Proposed Restoration Project: Maintain or Create Log Piles for Wildlife Habitat (see Map 2-6 and Table E-13)

Project Objectives

To provide denning/hiding/resting/foraging/escape sites for animals, including larger mammals such as American martin, fisher, bobcat, cougar, and bear.

Desired Future Conditions

Scattered piles of large wood with spaces to provide denning, hiding, resting, foraging, or escape sites for animals, including larger mammals such as American martin, fisher, bobcat, cougar, and bear.

Project Design Features

During salvage operations, leave piles of fallen logs in the selected areas where trees were cut to clear the right-of-way for the Pacific Power powerline in T32S, R1E, Section 5. Selected piles would be located near the east and west borders of section and one in the middle, away from the road.

Place or leave three additional piles of larger wood between West Branch Elk Creek and Flat Creek. These would be at or near the end of a road that will be closed either with a permanent block, earthen berm, or gate. This would be completed as part of the roadside salvage. Piles would be located in areas where roads identified for decommissioning are closed to traffic.

Piles should be approximately 20' x 20' and 4-6' high and provide space to allow animals access within the piles. Larger logs (>16" DBH) would be stacked in a loose, crisscross/haphazard pile in a way that would create spaces beneath the wood. The logs could be smaller lengths, broken tops, and boles large enough to stack with spaces between.

Logs would be obtained from salvage operations. Broken parts and whole logs would be hauled to location and piled. Piles should be located in the largest accumulation of trees. Pile locations could be moved to a different site if adjacent land owners object to specific road closures, or if there are inadequate snags in an area near the selected location.

Table E-13. Log Piles for Wildlife Habitat

Alternatives	Location	Number of Piles	Cost
A, B	No Projects	0	0
C, D, E, F, G	T32S, R1E, Sec. 5	3	$600
C, D, E, F, G	T32S, R1E, Sec. 24	1	$200
C, D, E, F, G	T32S, R1E, Sec. 29	1	$200
C, D, E, F, G	T32S, R1E, Sec. 24	1	$200

Proposed Restoration Project: Road Reconstruction (see Map 3-3b and Table E-14)

Project Objectives

Stabilize roads to reduce the risk of road failure.

Desired Future Conditions

Roads in a stable condition with a low risk of failure.

Project Design Features

Add drainage structures such as culverts and armored drain dips to reduce the chance of the road becoming saturated by water and failing. Remove unstable material from shoulders of roads and place large rocks on the face to armor the surface and function as a retaining structure to hold the fill in place. It is anticipated there would be a greater need for maintenance on roads within the fire over the next few years.

Table E-14. Road Reconstruction Projects

Alternative	Road Number	Description	Amount	Treatment	Cost
A	No Projects.				
B-G	32-1-9.1	Road near stream; Steep grade	2,750 Linear Feet	Add Drainage	$ 2,750
B-G	32-1-10.1	Unstable road fills	4,750 Linear Feet	Stabilize	$ 142,500
B-G	32-1-23.0	Road near stream	4,400 Linear Feet	Add Drainage	$4,400
B-G	32-1-26.0	Road near stream	2,000 Linear Feet	Add Drainage	$2,000
Totals			13,900 Linear Feet		$151,650

Proposed Restoration Project: Road Stream-Crossing Upgrades (see Map 3-3b and Table E-15)

Project Objectives

Reduce the risk of road damage from debris torrents plugging culverts and diverting stream flows down roads.

Desired Future Conditions

Road fills constructed of rock, rather than mixed soil and rock fills at stream crossings in high risk locations. Road segments below the pipe would be protected from water or debris torrents diverting from the channel and eroding a gully in the roadbed.

Project Design Features

Road fills constructed out of soil and rock fill material at high risk stream crossings would be replaced with rock fills. These fills would be designed with a dip over the culvert to keep the stream flow in the channel in case the culvert plugs. Culverts would be upsized to pass 100-year storm events and allow movement of water, gravels, and debris through the culvert.

Table E-15. Stream-Crossings Proposed for Upgrade

Alternative	Location	Risk Rating	Quantity	Treatment	Effect	Cost
A	No Projects.					
B, E, F	32-1E-10.1	5	300 c.y.	Reconstruct	Episodic 150 c.y.	$15,000
B, E, F	32-1E-10.1	5	300 c.y.	Reconstruct	Episodic 150 c.y.	$15,000
B, E, F	32-1E-10.1	4	200 c.y.	Reconstruct	Episodic 100 c.y.	$15,000
C, D, E, F, G	32-1E-15.0	4	200 c.y.	Reconstruct	Episodic 100 c.y.	$15,000
C, D, E, F, G	32-1E-17.4	3	300 c.y.	Reconstruct	Episodic 150 c.y.	$15,000
C, D, E, F, G	32-1E-17.4	3	300 c.y.	Reconstruct	Episodic 150 c.y.	$15,000
C, D, E, F, G	32-1E-20.0	4	200 c.y.	Reconstruct	Episodic 100 c.y.	$8,000
C, D, E, F, G	32-1E-20.0	4	200 c.y.	Reconstruct	Episodic 100 c.y.	$8,000
C, D, E, F, G	32-1E-20.0	4	200 c.y.	Reconstruct	Episodic 100 c.y.	$8,000
C, D, E, F, G	32-1E-20.0	4	200 c.y.	Reconstruct	Episodic 100 c.y.	$8,000
B, E, F	32-1E-20.1	5	300 c.y.	Reconstruct	Episodic 150 c.y.	$15,000
B, E, F	32-1E-20.1	5	300 c.y.	Reconstruct	Episodic 150 c.y.	$15,000
B, E, F	32-1E-20.1	5	300 c.y.	Reconstruct	Episodic 150 c.y.	$15,000
B, E, F	32-1E-20.1	5	300 c.y.	Reconstruct	Episodic 150 c.y.	$15,000
B, E, F	32-1E-20.1	5	300 c.y.	Reconstruct	Episodic 150 c.y.	$15,000
B, E, F	32-1E-20.2	5	300 c.y.	Reconstruct	Episodic 150 c.y.	$15,000
B, E, F	32-1E-20.2	5	300 c.y.	Reconstruct	Episodic 150 c.y.	$15,000
B, E, F	32-1E-20.2	5	300 c.y.	Reconstruct	Episodic 150 c.y.	$15,000
C, D, E, F, G	32-1E-20.4	5	300 c.y.	Reconstruct	Episodic 150 c.y.	$15,000
B, E, F	32-1E-29.0	5	300 c.y.	Reconstruct	Episodic 150 c.y.	$15,000
B, E, F	32-1E-30.1	5	300 c.y.	Reconstruct	Episodic 150 c.y.	$15,000
C, D, E, F, G	32-1W-13.0	4	200 c.y.	Reconstruct	Episodic 100 c.y.	$15,000
C, D, E, F, G	33-1E-4.0	4	200 c.y.	Reconstruct	Episodic 100 c.y.	$15,000
B, E, F	33-1E-8.0	5	300 cy	Reconstruct	Episodic 150 c.y.	$15,000
B, E, F	33-1E-8.0	5	300 cy	Reconstruct	Episodic 150 c.y.	$15,000
C, D, E, F, G	33-1E-26.5	3	200 c.y.	Remove Fills	Episodic 150 c.y.	$8,000

NOTE: In Risk Rating category, 3 is lowest risk of fill failure; 5 is highest risk.

Proposed Restoration Project: Road Maintenance (see Map 3-3b and Table E-16)

Project Objectives

To restore or improve road segments identified in the Transportation Management Objectives (TMO) process to the desired standard.

Desired Future Conditions

To maintain road access through BLM-administered lands while minimizing erosion and sedimentation from these roads and protecting water quality.

Project Design Features

Roads would be maintained and improved, as needed. Maintenance may include: blading and shaping the road surface, adding rock to the road surface, brushing the roadsides, cleaning the ditches, cleaning culvert catch basins, cleaning or replacing culverts, and adding drainage structures such as culverts and drain dips

Table E-16. Road Maintenance

Alternative	Miles of Road	Cost per Mile
A	0	0
B, C, D, G	100	$792,000
E	115	$814,000
F	68	$763,000

Proposed Restoration Project: Road Decommissioning (see Map 3-3b and Table E-17)

Project Objectives

To reduce the road density in the Key Watershed by decommissioning road segments identified in the TMO process. In addition, identify road segments for closure to reduce wildlife harassment, degradation to the road surface, and trash dumping.

Desired Future Conditions

Appropriate access to provide for administrative needs and public use. Most roads out of the riparian areas, and few with native surfaces. Access across public lands through reciprocal rights agreements will be maintained.

Project Design Features

Roads will be decommissioned or closed as identified from the TMO process.

Table E-17. Miles of Road for Closure or Decommissioning

Alternative	Miles of Decommissioning		Decommissioning Costs	Road Closures		Closure Costs	Total Cost
	Partial	Full		Miles	Gates		
A	0	0	$0	0	0	$0	$0
B, C, D, G	2.5	33	$243,500	21	16	$22,000	$265,000
E	5.3	38	$292,500	21	16	$15,750	$308,250
F	1.4	15.1	$112,700	14.4	11	$22,000	$134,700

Note: Gates cost $2,000 each and barricades are $750 each.

Proposed Restoration Project: Seasonal Road Closures (see Map 2-7 and Table E-18)

Project Objectives

Reduce damage to road surface during the wet season and protect sensitive fish species from surface road erosion; protect wildlife from poaching and harassment; and reduce trash dumping.

Desired Future Conditions

Year-round vehicle access would be restricted to mainline roads. Secondary and non-surfaced roads would be seasonally closed to motorized vehicles from mid-October through April 30. Only foot and non-motorized traffic would be allowed on closed roads during the wet season. All roads would be available for motorized vehicle traffic (unless fire restrictions are in place) from May 1 through mid-October. Roads would remain open to administrative access for landowners, BLM employees, and BLM contractors and permittees.

Project Design Features

Road closures would be seasonally closed to motor vehicles from mid October through April 30. Roads across private lands may or may not be closed by the landowner.

Table E-18. Roads to Remain Open Year-round

Alternative	Road Number	Description
E, G	33-1W-8.0	Buck Rock Road to West Branch
E, G	33-1W-10.0; 32-1W-26.1	Morine Tie Road
E, G	33-1E-17.0; 32-1W-26.0 to intersection with 32-1W-23.2	West Branch Elk Creek Road
E, G	32-1W-26.5	Alco Creek Road
E, G	32-1E-27.0; 32-1E-18.0 to intersection with 32-1E-18.3; 32-1E-20.0 to 32-1E-17.4; 32-1W-13	Flat Creek Road
E, G	32-1E-17.4 to 32-1E-17.5 to 32-1E-7.2	
E, G	32-1E-23.2; 32-1E-22.0	Miller Mountain Road
E, G	32-1E-23.0 to intersection with 32-1E-9.1, before stream ford	Sugarpine Creek Road
E, G	32-1E-10.1 to 32-1E-9.0; 32-1E-9.0	Gobblers Knob Road
E, G	32-1E-11.4 and FS 31	Elkhorn Ridge Road
E, G	32-1E-13.1 to intersection with 13.2 and 32-1E-13.2 to end of rocked area at boundary with section 11	North Mule Hill
E, G	32-1W-23.2	Ragsdale Butte
E, G	32-1W-36.1	

NOTE: No project proposed for Alternatives A, B, C, D, and F.

Proposed Restoration Project: Pump Chance Restoration (see Figure 2.3-1 and Table E-19)

Project Objectives

To restore existing pump chances and helicopter dip ponds for future fire suppression needs.

Desired Future Conditions

To have pump chances and helicopter dip ponds that will hold adequate pools of water, about 500 gallons, to be used primarily for initial attack fire suppression.

Project Design Features

Seven sites have been identified for restoration. The work would include cleaning pump chance pools by excavating gravels, soil, and vegetation that have built up. Excavated materials would be moved to an appropriate disposal site. Water inlets and outlets would be cleaned or repaired and rock would be added to access ramps as needed. Access ramps should have an adequate rock surface and be brushed to accommodate up to 4,000 gallon water tenders. Cascade Frogs would be protected by a seasonal restriction with no restoration occurring from mid-March to August 31.

Table E-19. Pump Chances Proposed for Restoration

Alternatives	Location	Remove Pool Materials	Other	Cost
A	No Projects			
B, C, D, F, G	32-1W-13.0	N/A	Replace Pipe; Brush Access	$750
B, C, D	32-1W- 23.0	5 yd^3	Build Gates	$1,500
B, C, D, F, G	32-1W- 25.2	5 yd^3	Replace Pipe; Rock Access	$1,000
B, C, D	32-1W- 26.0	Minor	None	$500
B, C, D, F	32-1W- 26.9	20 yd^3	Replace Pipe; Rock Access	$2,000
B, C, D	33-1W-8.0	Minor	Replace Pipe	$750
B, C, D	33-1W-14.0	Minor	Rock Access; Brush Access	$250

Proposed Restoration Project: Rock Quarry Closure and Rehabilitation (see Figure 2.3-1 and Table E-20)

Project Objectives

To close and rehabilitate rock quarries where the usable rock has been depleted and to minimize erosion from steep side slopes and lack of vegetation.

Desired Future Conditions

Abandoned rock quarries with vegetation growing in them and blended into the landscape.

Project Design Features

Rock quarries that are no longer viable would have benches sloped, soil imported (if necessary), and vegetation planted. Any oversized or usable material would be stored at the quarry or moved to another location where it would be stored until needed.

Five quarries are proposed for treatment: Gobblers Knob, Elk Horn Creek, Hawk Creek, Old Flat Creek, and West Branch Elk Creek.

Table E-20. Rock Quarries Proposed for Closure and Rehabilitation

Alternative	Location	Quarry Number	Quarry Name	Cost
A	No Projects			
B-G	T32S, R1E, Sec. 8	251	Gobblers Knob	$3,500
B-G	T32S, R1E, Sec. 3	316	Elk Horn Creek	$3,500
B-G	T32S, R1E, Sec. 8	317	Hawk Creek	$3,500
B-G	T32S, R1E, Sec. 29	334	Old Flat Creek	$3,500
B-G	T33S, R1E, Sec. 7	337	West Branch Elk Creek	$3,500

Appendix F
Report on Fire and Post-Fire Management Effects

Report on Fire and Post-Fire Management Effects - Butte Falls Resource Area

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I. Introduction and purpose

Frequent forest fires are part of southwestern Oregon ecosystems and have been a persistent disturbance in this region for perhaps tens of thousands of years. Historically, fires were viewed as disasters and were aggressively fought over the last 50 years. These fire suppression activities resulted in reduced extent of fire and increased fuel loadings. Today, knowledgeable citizens, managers, and scientists view fire as an essential component of functioning ecosystems and regard management of fuel loads as critical for community and rural residents' safety and for reducing fire severity.

In 2002, the largest wildfires in the state's recorded history prompted widespread interest in forest and fuel management effects on fire behavior and severity, the effects of fire on many ecological and social systems, and on the efficacy and wisdom of post-fire management activities. It was quickly recognized that the fires of 2002 provided a unique opportunity to learn more about these issues. A science team organized by the Cooperative Forest Ecosystem Research (CFER) program and composed of scientists from Oregon State University (OSU), the U.S. Forest Service Pacific Northwest (PNW) Research Station, the Bureau of Land Management (BLM), and the US Geological Survey (USGS) engaged in a series of activities during the winter of 2002/2003 to better understand information needs of managers and to suggest adaptive management approaches to pre-fire, fire, and post-fire management activities. The specific objectives of these activities were to:

1. identify important management and science fire-related questions worthy of further study
2. help shape study proposals to address these questions
3. provide information to the BLM to help the agency conduct post-fire planning, implementation, and monitoring
4. identify potential components of alternatives focused on learning objectives and adaptive management for post-fire management activities
5. build relationships among scientists and BLM managers interested in fire-related research in southwestern Oregon

This paper reports on the outcome of these efforts. Findings discussed here are simply a collection of observations based on our field review of fires on the Butte Falls Resource Area, our experiences elsewhere, and our knowledge of the current literature. The intent was to help sort issues and suggest ways to expand our knowledge, and we strongly suggest that use of our findings should keep the context of the observations in mind.

II. Methods

A science team based in Corvallis (see Appendix A for team composition) interacted with members of the Medford BLM District in two extended field visits. First, the team visited the Medford District in December 2002 to interact with approximately 45 forest managers and identify important management and research questions related to fire. The team spent a day in the field touring a recent large fire (the

Timbered Rock Fire, 2002) and learning about management concerns. The team and managers spent the following morning in a "brainstorming" session to discuss and identify priorities for management and science questions of interest.

Members of the science team returned to the Medford District in January 2003 to observe existing conditions at several previously burned sites on the Butte Falls Resource Area. The team spent two days in the field visiting five fires (Grave Creek, Sykes Creek, East Evans Creek, Hull Mountain, and Timbered Rock) that burned from 1978 to 2002. The team then participated in a half-day meeting with approximately 40 personnel from the Medford District to share observations and discuss limitations of existing knowledge concerning fire and post-fire management effects.

III. Post-fire management issues and discussion

Based on field observations, expert opinion, and knowledge of the current literature, the science team provided their opinions and observations on several issues related to post-fire management activities. These observations are summarized below with the acknowledgement of the general context in which they were given.

A. Are there likely to be significant soil compaction effects if areas are salvage logged?

Discussion:

As with any timber harvest activities, soil compaction could arise during fire-salvage operations. For standard logging systems, compaction is primarily limited to skid trails or possibly yarding corridors in cable logging operations. Site-specific conditions and harvest practices will strongly influence the magnitude and duration of compaction effects. Compaction could result in increased storm runoff in localized areas. Because of the potential for increased erosion and runoff in a post-fire environment, compaction effects could be more significant than in unburned areas.

Science status:

Many studies have shown soil compaction and reductions in nearby tree growth resulting from repeated passes of ground-based logging equipment, although significant areas of uncertainty remain. For example, the duration of compaction effects and whether compaction reduces stand growth are not well understood. The USDA Forest Service is participating in at least two long-term, site-productivity experiments addressing these questions. Although it may take decades before answers are forthcoming from these studies, results are available from a recent study conducted on the Willamette National Forest (Young Stand Thinning and Diversity Study) that evaluated the effects of several commercial thinning prescriptions and logging systems on soil compaction.

Summary:

Soil compaction is an important issue that merits attention when implementing salvage-logging practices. Careful design of logging practices and mitigation measures can minimize effects. Implementation monitoring is critical to adaptive management for soil compaction issues.

B. What is the extent of hydrophobic soils following fires, and does this condition merit treatment?

Discussion:

Although hydrophobic soils can result from high-severity fires, observations suggest that such soils are generally a small and transitory component of burned landscapes, and of more significance in other regions where coarse-grained soils predominate. Hydrophobic soils tend to physically break down once significant precipitation occurs. Little evidence exists of lasting ecological effects. Mechanical treatments to "break up" hydrophobic soils may not achieve ecological objectives and may lead to reduced site productivity and increased erosion.

Science status:

Little is known about hydrophobic soils resulting from fire in southwestern Oregon. Hydrologic studies following the 1987 Angel Fire in southwestern Oregon suggested minimal occurrence of water repellency over a limited range of burn conditions. New studies could be established to better understand the extent, magnitude, duration, or effect of hydrophobic soils across a broader range of burn conditions for different soil types in the Timbered Rock Fire.

Summary:

The limited spatial and temporal extent of hydrophobic soils may not merit significant investment of time and limited resources for management activities in the post-fire environment, but studies could be initiated to better understand the occurrence of hydrophobic soils and the potential effects at the watershed scale.

C. Should grass seed or other mitigation measures on burned areas be applied to reduce surface erosion?

Discussion:

In general, the most important activity to minimize surface erosion from burned forests is tree and shrub establishment. The contributions made by sprouting hardwoods, including shrubs, may be more important than planting conifers, especially in the short term. Little documentation from monitoring mulching and baling (bale bombing) activities exists, but observational and anecdotal evidence indicate that such activities may not significantly reduce surface erosion over the broad landscape. Highly disturbed and sensitive areas may benefit from grass seeding where high short-term risks exist and where grass can be established before potential erosional events. Similarly, contour felling to reduce erosion may be effective in small localized areas where highly erosive soils and high ecological values exist, but little evidence indicates it is an effective landscape treatment.

In most cases, seeded grasses will not persist where trees are re-established following fire. Tree shade will quickly reduce the extent of grass cover. When seed is applied, there is always risk of introducing exotic plants or noxious weeds that may persist in disturbed, open areas, such as along roads. Also, "weed-free" seed often contains a small percentage of weedy seed. There are many cases where unwanted exotics and weeds have been unwittingly introduced.

Science status:

Grass seeding and other mitigation measures are part of a standard toolbox for post-fire rehabilitation, but little formal evaluation of the effectiveness of these approaches has been conducted. Small-scale studies have been conducted in southwestern Oregon following the fires of 1987 and a large-scale evaluation of the Hayman Fire in Colorado is underway. The extensive fires in southwestern Oregon in 2002 may provide a basis for a regional study of the effectiveness of these approaches. At the local level, implementation and observational effectiveness monitoring should be part of any mitigation measures intended to reduce surface erosion.

Summary:

Although evidence suggests that measures intended to reduce surface erosion are not effective at a landscape scale, site-specific measures (i.e., grass seeding, contour felling) may be effective on highly sensitive sites where ecological values are high. A comprehensive evaluation of these measures at spatial scales ranging from local to regional could be valuable.

D. Does timber salvage lead to increased erosion?

Discussion:

The effects of timber salvage on erosion are primarily limited to surface erosion, unless the salvage activity includes substantial levels of green tree harvest. Tree roots hold soil on steep slopes reducing the extent of mass movements, but roots of fire-killed trees likely decompose on the same trajectory whether or not the tree bole is harvested. Surface erosion can occur from salvage harvesting similar to any harvest activity that includes road construction, skid roads, or yarding corridors. Site-specific conditions and harvest practices will strongly influence the magnitude and duration of surface erosion. Mitigation measures have been developed to reduce erosion, and many of these measures have been integrated into standard harvest practices. When the extent of the burned area is large, downslope effects from erosion may be more significant than in unburned areas.

Science status:

There is strong evidence that erosion from salvage logging can result in negative cumulative effects in a post-fire environment. In areas where salvage logging is conducted, surface erosion mitigation measures should be implemented to minimize erosion. Although general surface erosion mitigation measures for standard timber sales are well known and applicable to salvage harvests, little direct monitoring of surface erosion from timber salvage in southwestern Oregon has been documented. We suggest implementation monitoring of prescribed mitigation measures and documentation of the effectiveness of these measures.

Summary:

Surface erosion from roads and skid trails used for salvage logging does occur, and every effort should be taken to minimize erosion in post-fire landscapes. Prevention and mitigation measures can be applied to minimize erosion and should be monitored.

E. Have fires and post-fire salvage activities increased stream temperatures?

Discussion:

Stream temperatures may rise from reduced shading due to fire-induced mortality of riparian vegetation. The significance of increased heat energy reaching the stream changes from stream-to-stream depending on stream orientation, influence of ground water sources and hyporheic flows, and the vigor of streamside shrubs. For example, warming through direct solar radiation may persist downstream as the stream passes through additional shade-free areas or may be insignificant where cool groundwater and hyporheic flows control stream temperature. Streamside buffers left during salvage activities can maintain the partial shade provided by snags. If timber salvage includes harvest of green trees currently shading perennial streams, stream temperatures could significantly increase. Harvest of fire-killed trees that currently shade streams also could increase the heat energy reaching the stream surface, although not to the degree associated with harvesting of green trees.

Science status:

Understanding the factors controlling stream temperature, including the influence of management activities, is a topic of ongoing research. Current work is aimed at examining the influence on stream temperatures of groundwater and hyporheic flows as well as streamside vegetation. Studies could be implemented to evaluate the degree of shading provided by alternative riparian buffers in timber salvage operations. Current research is aimed towards development of models that predict the influence of alternative harvest practices across a wide range of potential treatments based on fundamental ecological processes, but there is a critical need for information concerning the watershed-scale influence of site-level temperature changes.

Summary:

Increases in stream temperature following fire may be significant depending on fire severity, slope, aspect, elevation, the influence of groundwater inputs, stream location within the stream network, and other factors. Retention of streamside buffers during salvage activities minimizes the effects of salvage logging. Studies could be implemented to better document the effect of fires and timber salvage on stream temperature, but current studies and modeling efforts may provide the information needed to predict stream temperature responses to future fires. Temperature monitoring at a variety of spatial scales (i.e., local to watershed) could provide important information concerning the effects of salvage logging procedures and practices.

F. Do fires influence stream channel morphology, and are there rehabilitation measures that can mitigate these effects?

Discussion:

Fires can and do influence stream channel morphology through potential increases in stream discharge or through introduction of sediment and channel forming materials from erosion. The key consideration is whether the stream channel has sufficient structure to capture and arrange these materials to form complex habitats. Many streams in this area have been eroded to bedrock, primarily through splash dam

logging in the first half of the last century. In some streams, large numbers of additional wood pieces or large boulders are needed to influence the routing and storage of large sediment. Where roads adjoin streams, felling roadside hazard trees into streams can be done to increase channel structure. Adding logs with rootwads can greatly reduce log travel distance if downstream structures are vulnerable (i.e., buildings, bridges). Other sources of wood are abundant on the landscape.

Science status:

Many in-stream restoration projects have been completed in the last two decades; however, very few have completed long-term monitoring. One of the longer running studies in western Oregon was installed on a tributary of the McKenzie River in 1986. Significant local increases in channel and habitat complexity, litter retention, and juvenile trout recruitment have been documented. An important limitation of this study and other restoration monitoring projects is that the spatial scale is restricted to an individual stream reach or two. Fish populations respond at much larger scales. More comprehensive studies at larger scales are needed to better understand fish population responses to in-stream restoration.

Another aspect of this study was a comparison of log movement among unanchored logs, logs anchored at one end, and logs anchored at both ends. Log movement was tracked over time and reevaluated after a major flood event (February 1996). No difference was found in the proportion of logs moved (anchored vs. nonanchored), but anchored logs moved shorter distances. A large trash rack was installed downstream of the wood introduction to protect a bridge, but was taken out after 10 years because of the limited movement of large wood.

Summary:

Channel morphology may change in response to fires. Channel forming structure is needed in streams to create complex habitats by influencing stream flow and coarse sediment input. In some cases it may be necessary to add wood (i.e., felling trees into the channel) to encourage accumulation of wood and sediment following fire. Large-scale monitoring of post-fire channel morphology and fish population response is needed.

G. Is large wood located on potentially unstable upland sites important for slope stability and stream channel inputs?

Discussion:

Salvage logging of unstable sites may not affect the probability of mass movements because there is little difference in root decay of standing dead trees versus stumps. It is possible, however, for poorly designed logging operations to destabilize slopes, particularly through road construction or maintenance activities.

The more important factor for many sites is the potential for landslides and other mass movements from upland areas to provide large wood and coarse sediment to streams. Mass movements are critical to channel structure-forming processes and provide the materials essential for creating complex stream habitats in the long term. If large trees are left on unstable slopes in burned areas or large trees are encouraged to develop from younger stands on these sites, the resulting large wood could contribute to stream channel structure when mass movements occur.

Science status:

Recent science has clearly demonstrated the role of unstable upland sites in providing large wood and coarse sediment to streams in the Coast Range. Although these processes occur in the Cascade Range, their relative importance is not clear and is a subject of ongoing investigation. Field mapping and long-term monitoring of unstable slopes within a recently burned area could increase our knowledge of the frequency and significance of mass movements of large wood and coarse sediment to streams from upland sources.

Summary:

Development and maintenance of large wood on unstable slopes ensures that large wood delivery to streams will occur during mass movements. Field mapping and monitoring of these sites can provide useful information.

H. Are there specific post-fire watershed restoration activities that are both effective and important for watershed processes and aquatic habitats?

Discussion:

Roads alter several important watershed processes. Roads and culverts can impede fish movement, convert subsurface water flows to surface flows, contribute chronic fine sediment to streams, and initiate mass movements laden with fine sediment. Consideration of reducing the impact of roads is appropriate during post-fire recovery planning. There is high variability in the risk individual roads pose, and each road needs to be assessed independently and in the context of the watershed as a whole. Restoration measures include sidecast pullback, waterbar placement, culvert excavation and stream channel restoration, or replacing older culverts with a variety of contemporary stream crossings that allow passage of aquatic vertebrates. Each of these measures can be effective if properly designed for the local situation and management objectives.

Science status:

Few watershed restoration measures have incorporated long-term monitoring. A limited effectiveness monitoring project in the McKenzie River watershed showed that following culvert excavation on two road segments, stream channels were re-established that approximated pre-road stream gradients. Opportunities for designed studies comparing alternative restoration techniques exist.

Summary:

Improving road conditions can be one of the more effective approaches to restoring watershed functions. Individual roads should be assessed to determine their relative influence on watershed processes and the most effective technique for reducing their impact; however, restoring connections within the stream network by renovating culverts and other road crossings may be the most effective restoration measure taken in many watersheds. Long-term monitoring of restoration methods is needed.

I. Is there any increase in stream discharge due to fires, and would timber salvage have any additional influence on discharge?

Discussion:

The primary mechanisms for increased stream discharge in a watershed are increased ground water due to decreased evapotranspiration, increased snow accumulation and melt from rain-on-snow events, and conversion of subsurface flow to surface flow due to mid-slope roads. The importance of each mechanism varies by watershed depending on soil depth, elevation, site productivity, and other factors. Water yield increases are directly related to the mortality of vegetation. Fire can decrease evapotranspiration if mortality is high and productivity is low, potentially increasing discharge in a burned area. Yield will likely increase in the short term, but as vegetation is reestablished, yield will decrease. If salvage logging does not kill additional trees, salvage activities probably will not influence discharge levels. Most of the fires observed by the science team were below the transient snow zone, and snow pack hydrology may not be influential in these areas. Fire does not affect road density, but if mid-slope roads are built to facilitate salvage operations, discharge could increase due to this mechanism.

Science status:

The basic mechanisms by which forest management activities affect stream discharge have been studied for decades and are generally known; however, the degree to which these mechanisms operate in any given watershed varies. These mechanisms have not been studied in post-fire environments in western Oregon. Assessing the influence of management activities on stream discharge has proven notoriously difficult and expensive and is a long-term proposition. This is not likely to be a fruitful avenue for study at a project scale.

Summary:

Until forest canopy cover is re-established, water yield may increase following fire due to decreased evapotranspiration. Timber salvage is not likely to affect water yield unless new mid-slope roads are built or significant numbers of green trees are included in the harvest. The presence of woody debris, both on the ground and in the stream, can have an important influence on the hydrological effects of increased water yield, however.

J. What are the risks of noxious weed invasion following fire, and what management activities might retard or accelerate weed invasion?

Discussion:

There is almost always potential for weed invasion in disturbed areas if an environmentally adapted seed source is available. Attention should be paid to potential weed invasion after recent large-scale disturbances, such as burns. In most cases, noxious weeds will be shaded out as canopy cover re-establishes following fire. The presence of woody sprouting species may benefit many sites by rapidly reoccupying the site. Other areas that persist as “openings”, such as roads or meadows, may need more active management to minimize noxious weed establishment. It may be desirable to seed native grasses on certain sensitive sites to occupy the ecological niche and preempt weed invasion (e.g., disturbed areas that are close to a weed seed source and lack sprouting vegetation). Roads are potential dispersal

pathways for many weeds and may need special attention if adjacent to sensitive sites.

Many management activities, including those intended for watershed restoration, could accelerate weed invasion, particularly through seed dispersal on vehicles or equipment. Mitigation measures, such as washing vehicles and equipment prior to entering the site, can minimize invasion risk.

Science status:

Basic research is needed on individual weed species ecology and effective invasion prevention and treatment methods. Current research is trying to link geographic spread and demographic models so that potential weed dispersal patterns can be predicted and potentially prevented where warranted. These are regional issues needing regional attention. However, monitoring is a critical activity at the scale of an individual fire. Burned areas should be monitored to determine if weed invasion is occurring. Management activities should be monitored to verify that mitigation measures are being applied and are effective.

Summary:

Weed invasion could occur following fire. Seeding with native species to prevent invasion may be warranted on sensitive sites, but the potential for introduction of non-native species from contaminated seed sources is a significant concern. Implementation and effectiveness monitoring are critical activities.

K. How does salvage logging affect future fuel loadings?

Discussion:

Salvage logging removes dead and dying trees, thus reducing large fuels in both the short and long term. Salvage logging also creates fine and mid-size fuels by leaving treetops, branches, and needles on site, thus increasing fuels in these size classes in the short term. Fine and mid-size surface fuels also occur in unsalvaged areas, but accumulate gradually over a couple of decades. It is unlikely that these fuels would reach the same magnitude as in the post-salvage scenario because decomposition occurs as new material accumulates.

The effect of surface fuels on fire behavior is complex. Flame length and fire spread is correlated with fine and mid-sized fuels, while fire duration and thus soil heating and plant injury or death may be more closely correlated with large fuels. Thus, salvage logging could increase the risk of fire spread in the short term while decreasing fire intensity and severity in both the short and long term. Thresholds defining when fuel profiles and fire intensity result in significant negative ecological effects (e.g., declines in long-term soil productivity) have not been determined. These interactions vary depending on snag falldown rates and decomposition rates of specific species and sites.

Science status:

Quantitative data describing falldown and decomposition rates of snags on salvaged and unsalvaged burned sites in southwestern Oregon have not been compiled. Several of the science team members submitted a proposal to the Joint Fire Sciences Program in January 2003 to address this and other information gaps through a retrospective examination of older fires in southwestern Oregon. A second

step included in the proposal was to use this information to model fire behavior in salvaged and unsalvaged areas to estimate effects of various fuel profiles on fire extent and severity.

Summary:

Salvage logging undoubtedly affects fuel profiles in complex ways, but the data and analyses necessary to make conclusive statements about the net effect of these changes on future fire extent and severity have not been conducted.

L. Is herbaceous species diversity higher in salvaged or unsalvaged areas?

Discussion:

Some studies in disturbed areas have shown initial increases in plant diversity due to establishment of exotic plants, followed by a decrease in diversity with canopy closure. A more important question might be whether herbaceous species are lost in salvaged areas. Species loss is very difficult to determine because rare species, which are most likely to be lost from a site, are very difficult to monitor. Information sufficient to answer this question has not been obtained to date. Another, potentially more relevant question, concerns the effects of salvage logging on epiphytic lichens, bryophytes, and fungi, particularly those which disperse very slowly into new habitats.

Science status:

Most herbaceous species can be readily monitored to determine the effects of salvage logging on species richness and abundance. Replicated monitoring plots could be established within the salvaged and unsalvaged areas. Long-term studies may be needed to assess effects on rare species.

Summary:

Monitoring plots could be established to measure the effects of salvage logging on herbaceous species diversity; however, additional skills and techniques will be needed to detect differences in epiphytic lichens, bryophytes, and fungi diversity.

M. How does residual snag density affect wildlife, or, how much is enough?

Discussion:

There is no definitive answer to the question “how much is enough?” There are as many value-based dimensions to the question as technical aspects. Issues of risk tolerance (e.g., short-term risks versus long-term risks) and the desired balance among competing objectives play heavily in choosing among approaches.

It is clear that dead wood plays a critical role in providing wildlife habitat; however details concerning influences of quantity, characteristics, and spatial distribution of dead wood on wildlife after fire is less clear. The relationship between snag density and population response of wildlife is uncertain. Also, the effects of alternative spatial patterns (e.g., clumped vs. dispersed) are not known, although clumping

snags may facilitate safer logging operations, as well as use by certain bird species like woodpeckers. It is well established that in general large diameter snags provide important resources to wildlife that are not provided by smaller snags. For example, cavities large enough for large vertebrates, such as the pileated woodpecker, can only be excavated from larger snags.

Numerous other issues should be considered. Snag creation and decomposition occur over multiple decades requiring a long-term view if the goal is to provide temporal connectivity until the next stand generates new snags. Snags provide ecological functions other than wildlife habitat (e.g., source populations of lichens), which may be a factor to consider when designating snags for retention. The surrounding landscape may provide some clues regarding locations for snag retention. It may be of value to concentrate snags in areas where there are few in the surrounding landscape or in areas where snags are more likely to survive high wind events or future fires.

There are a number of wildlife species that use snags: cavity-nesting birds, bats (especially snags with bark remaining), and spotted-owl prey species, such as flying squirrels and woodrats. Based on a general understanding of species' life history and habitat requirements, we expect that fire directly impacts flying squirrel and woodrat populations through mortality and habitat destruction. Secondary impacts are also likely due to reduction in fungi and lichen food resources. Abundant opportunities for nesting cavities will be available as these stands start to recover. Most wildlife populations will likely recover after pronounced short-term (5-10 years) impacts. In addition, some wildlife and plant species are expected to increase in post-fire and early successional forest habitats.

Science status:

Given the importance of snag-related issues, it is disconcerting how little is known. Although we can glean some information from studies of snags in clearcuts and studies in other geographic regions, post-fire snag studies have not been conducted in western Oregon. However, a number of important questions concerning wildlife use of snags following fire are amenable to a large-scale field study that could be implemented through post-fire salvage operations (see next section). Treatments that span a range of snag densities could be established and replicated across a landscape and monitored over the long term. Questions of snag dynamics and use could be addressed through such a study.

Summary:

It is clear that snags play an important role for wildlife following fire, but the question of how many snags should be retained to achieve wildlife goals is unclear. Although this question is ultimately one of policy, important technical and ecological questions remain unanswered. A large-scale field study could help answer these questions.

N. What considerations should guide reforestation decisions?

Discussion:

It is well understood how to re-establish trees on a site. For some sites, it may be more important to focus on tree survival rather than maximum stand growth. For example, lower planting densities and less intensive release and weeding operations may be appropriate when tree survival is the goal. Also, it is important to look at the future impact of early silvicultural treatments on fuel management. Clear goals

for future stand structure and composition will help guide replanting and other silvicultural decisions. Currently, silvicultural regimes designed for survival and development of late-successional habitat in the frequent fire zones of southwestern Oregon are not well understood. There may be an inherent trade-off between fire-proofing stands and creating complex stand structures. Obtaining mature forest habitat may require passing through a developmental stage that is highly flammable.

Science status:

Although reforestation techniques for maximum stand growth and yield are well understood, efficient approaches for growing late-successional habitat in southwestern Oregon are not. In particular, methods of minimizing risk of stand loss through fire need to be developed and integrated with habitat goals. These questions are amenable to a field study. Relatively small plots (1-2 acres each) could be established with alternative reforestation densities, tree species, and release regimes implemented in both salvaged and unsalvaged areas.

Summary:

Where late-successional habitat is a primary objective, reforestation and silvicultural regimes may be best focused on tree survival. A relatively small-scale field study could effectively address silvicultural regime questions.

IV. Alternative field study designs

The science team and BLM managers and specialists discussed various ideas for experimental treatments that would help build knowledge for future EIS teams facing similar questions and issues. Key considerations include a clear set of questions to drive the design of an experiment and sufficient rigor in the design to produce reliable results.

A number of factors influence the rigor and reliability of field studies:

- Replication - It is important to reduce the role of chance occurrences by repeating the suite of study treatments several times across the landscape.
- Randomization - It is important to reduce the bias inherent in assigning specific treatments to specific sites. Random assignment of treatments accomplishes this need. The implication is that managers need to be willing to apply any of the treatments on any site.
- Controls - Study controls are essential so the existence of a treatment effect can be established. There are different types of controls, and this issue needs to be built into the design from the beginning.
- Treatment extremes - Treatment extremes on both ends of the spectrum are needed to demonstrate and frame outcomes.
- Spatial scale - The appropriate spatial scale of the study depends on the questions being addressed. For example, if you want to address wildlife issues, than an area large enough to measure wildlife response (i.e., home range size) needs to be included in the study. Furthermore, it is important to differentiate between local- and watershed-scale effects, and this may require a multiple-scale study design.
- Temporal scale - The scale of the questions being addressed will also dictate the temporal scale of the study. Long-term studies require thinking ahead to determine how treatments will be applied through time and requires a long-term commitment of these sites to the study.

The science team identified two primary areas for study that address high priority management questions related to post-fire management activities. The first study would address the question "how does salvage intensity influence wildlife and fuels?" The study would include four treatments; two that represent alternative approaches to meet management objectives and two that represent a more intensive extreme and an unsalvaged area. Treatment units would need to be at least 30 acres in size so that wildlife responses could be measured and four replications should be implemented.

A second study could address understory treatments. Specifically, it would address the question "how does planting , species composition, planting density and subsequent vegetation treatments influence reforestation and fuels?" This study would include two alternative planting densities, two planting species mixes, and two release regimes. Each set of treatments would be implemented in both salvaged and unsalvaged areas, and on both north-and south-facing slopes. Unplanted plots would need to be included for a control. Plot size could be much smaller, one to two acres in size, and replicated three to four times.

These general ideas are a starting point. Further discussion and clarification of the primary objectives are needed to integrate management and research interests and to fit the studies to the landscape.

V. Conclusions

The interaction among science team members and resource managers and specialists from the BLM Medford District has proven valuable from a number of perspectives. This report may help interdisciplinary teams sort high priority issues from more minor concerns, and it identifies key information gaps that field studies and monitoring activities could address. It is important to recognize that this report is also limited in a number of respects, including an absence of a thorough review of the literature, absence of any data or quantitative assessment of fire and management effects, and the restricted disciplinary expertise and experience of the science team members. The report is intended to apply only to southwestern Oregon and, even within that region, is most applicable to the types of sites found on the Butte Falls Resource Area.

The process has also proved beneficial by building relationships among managers and scientists, and by increasing the mutual understanding of science processes and management realities and needs. Managers involved in this process gained a better appreciation for the limitations of the current knowledge base and of the difficulties inherent in determining cause and effect. Scientists involved in the process have been exposed to a real-time management environment where decisions have to be made in the short term, with or without solid data. The outcomes of this report will hopefully point a way towards increased management-science collaboration through adaptive management processes where management questions are tested using the methods of science in an operational management program.

Appendix A

Science team members, affiliation, and discipline

December 2002 Science Team

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Sam Chan (PNW, silviculture, microclimate)
John Cissel (BLM, BLM science liaison, forest ecology)
Janet Erickson (CFER/OSU, CFER information exchange specialist, wildlife ecology)
Bob Gresswell (CFER/USGS FRESC, fish biology, watershed processes)
John Hayes (CFER/OSU, CFER program coordinator, wildlife ecology)
Erin Hyde (USGS FRESC, wildlife ecology, amphibians)
Jeff Miller (OSU, entomology)
Pat Muir (OSU, botany, nonvascular plants)
Kari O'Connell (OSU, forest ecology)
Dede Olson (PNW, aquatic vertebrates, amphibians)
Steve Perakis (CFER/USGS FRESC, forest productivity, nutrient cycles)
Klaus Puettmann (OSU, silviculture, forest ecology)
Jeff Shatford (CFER/OSU, forest ecology)
Fred Swanson (PNW, geologist, forest ecology)
John Tappeiner (OSU, silviculture)

January 2003 Science Team

Paul Anderson (PNW, silviculture, forest restoration, plant physiology)
Michelle Donaghy Cannon (CFER/OSU, wildlife ecology)
John Cissel (BLM, BLM science liaison, forest ecology)
Janet Erickson (CFER/OSU, CFER information exchange specialist, wildlife ecology)
Bob Gresswell (CFER/USGS FRESC, fish biology, watershed processes)
John Hayes (CFER/OSU, CFER program coordinator, wildlife ecology)
Steve Perakis (CFER/USGS FRESC, forest productivity, nutrient cycles) (field trip only)
Klaus Puettmann (OSU, silviculture, forest ecology)

Appendix G
Research Proposal

Evaluation of the influences of salvage and salvage intensity on wildlife
A research prospectus

October 14, 2003

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Recent fires throughout the western states have heightened interest in the influences of post-fire management activities on a variety of ecological processes, social goods and services, and forest attributes, including forest health, ecosystem integrity, future management options, and wildlife habitat (McIver and Starr 2000). Salvage of dead trees has been of particular interest because of the potential economic benefits of harvest activities and the influences of salvage on risk of future fire and insect outbreaks. Salvage also has been highly controversial because of known or hypothesized environmental impacts on soil, water, and biodiversity. Despite the coupling of potential social benefits and possible environmental impacts, a large number of questions remain about basic relationships between salvage and ecosystem response.

A key issue related to salvage activities concerns potential influences on wildlife and wildlife habitat. Most research of the effects of post-fire salvage logging has been conducted on avian species although some work has been conducted on other wildlife taxa (e.g., Haim and Izhaki 1994). In general, bird species richness and abundance generally are lower in burned stands that are heavily salvaged relative to unsalvaged stands (Caton 1996, Hitchcox 1996, Saab and Dudley 1998). However, substantial gaps in our knowledge remain concerning the effects of salvage on wildlife, and most of the research has been conducted outside of the Pacific Northwest (reviewed by Kotlier et al. 2002). Most notably, there are few studies that examine influences of different levels of salvage logging on wildlife. Moderate salvage logging that retains sufficient numbers of suitable snags may not have negative effects on some cavity nesting bird species (Saab and Dudley 1998). Existing research suggests that avian species most closely tied to early post-fire habitat may be most sensitive to salvage (Kotlier et al. 2002). As a consequence of lack of geographically relevant information, short- and long-term responses of wildlife populations to changes in forest structure resulting from salvage, the influences of different salvage intensities on wildlife response, and implications for development of late-seral attributes remain speculative.

This prospectus provides an outline of proposed research to investigate the influences of post-fire salvage and salvage intensity on wildlife response in the Timbered Rock Fire in the Butte Falls Resource Area of the Medford District of the BLM.

Objective

To determine the relative influence of 2 salvage intensities on wildlife populations.

Study area

This research will take place on lands managed by the Butte Falls Resource Area, Medford District of the BLM in areas burned during the Timbered Rock fire. The Timbered Rock Fire burned roughly 27,000 of federal and private forest in July, 2002. Approximately 11,775 acres of the fire occurred on lands managed by the BLM. The BLM lands are designated as Late Successional Reserve under the Northwest Forest Plan.

In collaboration with staff of the Medford District of the BLM, potential study sites within the Timbered Rock Fire were identified. Sites meeting the following criteria were considered to be potential sites for study: 1) the site had burned with a high fire intensity, 2) the site was at least 30 (preferably at least 40) acres in size, and was not exceptionally sinuous in shape or did not include elongate extensions, 3) the sites consist of good stocking of conifers $\geq$ 40 inches dbh, 4) the site could accommodate at least three non-overlapping 80 m radius bird survey circles, and 5) it was logistically feasible and reasonable to assign any treatment to any site. Initially, 16 sites were identified by the BLM that were thought to meet the criteria provided. On further investigation, it was found that four of these sites had inadequate numbers of large diameter trees to meet our criteria. These 4 sites were eliminated, resulting in 12 sites available in the area for the study.

Treatments
Three treatments will be implemented in the study:

1) Control. No salvage activity will occur on control sites.

2) Moderate salvage prescription. Salvage activities will occur on 70% of the site. In the salvaged area, six trees per acre, > 20 inches DBH will be retained. Retained snags will be dispersed throughout the salvaged area. The remaining 30% of the site will not be subjected to any salvage activity. If riparian areas are present, the unsalvaged will be oriented to include the riparian habitat. This prescription is designed to emulate likely salvage activities on BLM lands in the region, where sensitive areas, such as riparian areas, are left unsalvaged.

3) Heavy salvage prescription. The entire site will be salvaged. Six trees per acre >20 inches DBH will be retained throughout the site. Retained snags will be dispersed throughout the site.

Treatments were randomly assigned to stands. The resulting allocation of treatments is illustrated in Figure 1.

Aside from salvage activities, all management activities will be identical among treatments. For example, each area should receive the same underplanting density, vegetation control, etc. To the extent that activities undertaken on the sites do not impact the field experiment, all management activities conducted on the sites will be as similar to typical operational practices as possible.

Timing of salvage

Salvage should occur during a relatively narrow window of time to minimize impacts of salvage on data collection and to maintain the integrity of the research design. Salvage treatments should be installed so to meet three criteria: 1) no salvage activity should take place in the experimental plots from May 15 through July 7, to avoid data collection during the breeding bird season; 2) all salvage will be installed during the same time period, on a given year from July 7 through May 15 of the following year (e.g., between July 7, 2003 and May 15, 2004); and 3) no logging will occur on stands adjacent to or nearby to the experimental plots between May 15 and July 7 before 10:00AM.

Field methodologies

Bird populations. During the summer of 2004, we will establish 3 bird-sampling points in each experimental stand. Sampling points will be the chosen so that the distance between points is at least 160 m, and arranged so as to maximize distance between sampling points and stand boundaries. We will conduct bird sampling at each point between May 15 and July 7 during 2004 and 2005. Additional years for study will be determined later in consultation with the BLM, depending on interest and availability of funding. Sampling at least through 2007 may be desirable as changes in habitat structure during the initial years following fire and salvage can be dramatic. We anticipate 2 to 5 years of initial study to evaluate short-term impacts of salvage on birds, followed by additional future work to evaluate moderate- and long-term impacts. Each point will be visited a minimum of four times each year. Bird sampling will be conducted for an 8 minute time period at each point, between one-half hour before and three hours after sunrise. Distances from the observer to each bird will be recorded, and data will be analyzed using standard methodologies. Whenever possible, population density will be estimated rather than using indices of abundance. We will explore use of territory mapping or behavioral observations to evaluate patterns of habitat use within study sites.

Small mammals. Small mammals are of interest because of the key ecological role they play as predators of seeds and insects, dispersers of seeds and mycorrhizal fungal spores, and prey to northern spotted owls and other predators. Although size of the proposed treatments are not suitable to investigate treatment influences on flying squirrel population densities, they are adequate to evaluate use of sites by flying squirrels, and population-level responses of woodrats and other small mammals, including chipmunks, mice, voles, and shrews. We will establish a grid of Tomahawk live traps (for flying squirrels, woodrats, and chipmunks), and Sherman live traps or other traps (for mice, voles, and shrews) at each of the study sites. Trapping will be conducted for a minimum of five days during the spring and fall of 2004 and 2005. Additional years for sampling will be determined later in consultation with the BLM, depending on interest and availability of funding. We anticipate 2 to 5 years of initial study to evaluate short-term impacts of salvage on small mammals, followed by additional future work to evaluate moderate- and long-term impacts. Investigation of response of these species would involve establishing trapping grids on the sites and standard mark-recapture analyses (Thompson et al. 1998). Whenever possible, population density will be estimated rather than using indices of abundance.

Significance and Justification

Salvage and Late Successional Reserves

The Record of Decision (ROD) for the Northwest Forest Plan provides basic guidelines for the conditions under which salvage may occur in Late Successional Reserves. The ROD allows for salvage to prevent negative effects on late-successional habitat and to facilitate habitat recovery. The ROD specifically addresses the potential use of salvage to reduce catastrophic insect, disease, and fire threats. However, the ROD restricts activities that diminish habitat suitability in Late Successional Reserves now or in the future. Unfortunately the information base to fully evaluate the influences of salvage activity on habitat restoration and the short- and long-term impacts of salvage on habitat suitability is not available. This work would provide information on the influences of salvage and salvage intensity on habitat quality and abundance of wildlife species. In addition, if resources are directed to examining influences of salvage on stand structure, research on these sites could provide information on the influences of salvage on habitat recovery and development of late successional characteristics.

Applicability of findings beyond the Timbered Rock Fire

The proposed research will help fill a number of important gaps in our understanding of the influences of salvage on wildlife populations. The experimental, manipulative approach outlined here, combined with random allocation of treatments to sites proposed for this project provides the framework for inference of causality with minimal bias. In contrast, observational research is correlative in nature and cannot be used to infer causality, and research that does not invoke randomization of treatments and controls are subject to potential sampling biases. As a result, very strong inference can be gained from this research and it is likely to impact post-fire management on other public and private lands in southwestern Oregon and throughout the western states.

Deliverables

Products of the proposed project for delivery to the BLM will include annual progress reports during the years when active research is being conducted. In addition, I anticipate that the proposed research will yield at least 2 Master's theses and 3-5 peer-reviewed scientific journal articles (depending on the time frame of the study and the number of wildlife taxa examined).

Project Schedule

Below is a potential schedule for research, based on four years of initial post-treatment data collection. Actual duration of the initial data collection is subject to funding availability. Timing and duration of second and third data collection sessions is subject to modification depending on availability of funding, interest of the BLM, patterns of stand development, and findings of the initial data collection sessions.

Years 1-4
: Initial post-treatment data collection on wildlife populations and habitat characteristics.

Year 5
: Analysis and publication of initial post-treatment data.

Years 10-11
: Additional post-treatment data collection on wildlife populations and habitat characteristics.

Year 12
: Data analysis and publication of results.

Years 18-19
: Additional post-treatment data collection on wildlife populations and habitat characteristics.

Year 20
: Data analysis and publication of results.

Budget

Separate budget estimates are provided here for two studies: a bird response study and a small mammal (spotted owl prey species) response study. Both studies include habitat assessments as well as direct evaluation of wildlife communities.

Costs are provided for the first 6 years of the project (years –1 through 5); actual costs for years 3-5 will depend on decisions made concerning the amount of field sampling to be done. Similar expenses for later entries could be anticipated, modified based on inflation. Higher costs during year –1 largely reflect costs of supplies for study establishment (mostly traps for the mammal study). If pre-treatment sampling is not possible, these costs would be transferred to year 1. Expenses may be reduced if the BLM is able to provide housing for the field crew and vehicles for field work. Estimates are made based on 15% indirect costs rate for transferring money from the BLM to OSU through the CESU.

Bird study budget

Year	Direct Costs	Indirect Costs	Total
Year 1	57,750	8,862	66,413
Year 2	57,750	8,862	66,413
Year 3	57,750	8,862	66,413
Year 4	57,750	8,862	66,413
Year 5	50,250	7,537	57,788

Mammal study budget

Year	Direct Costs	Indirect Costs	Total
Year 1	98,250	14,737	112,988
Year 2	77,250	11,587	88,838
Year 3	77,250	11,587	88,838
Year 4	77,250	11,587	88,838
Year 5	53,250	7,987	61,238

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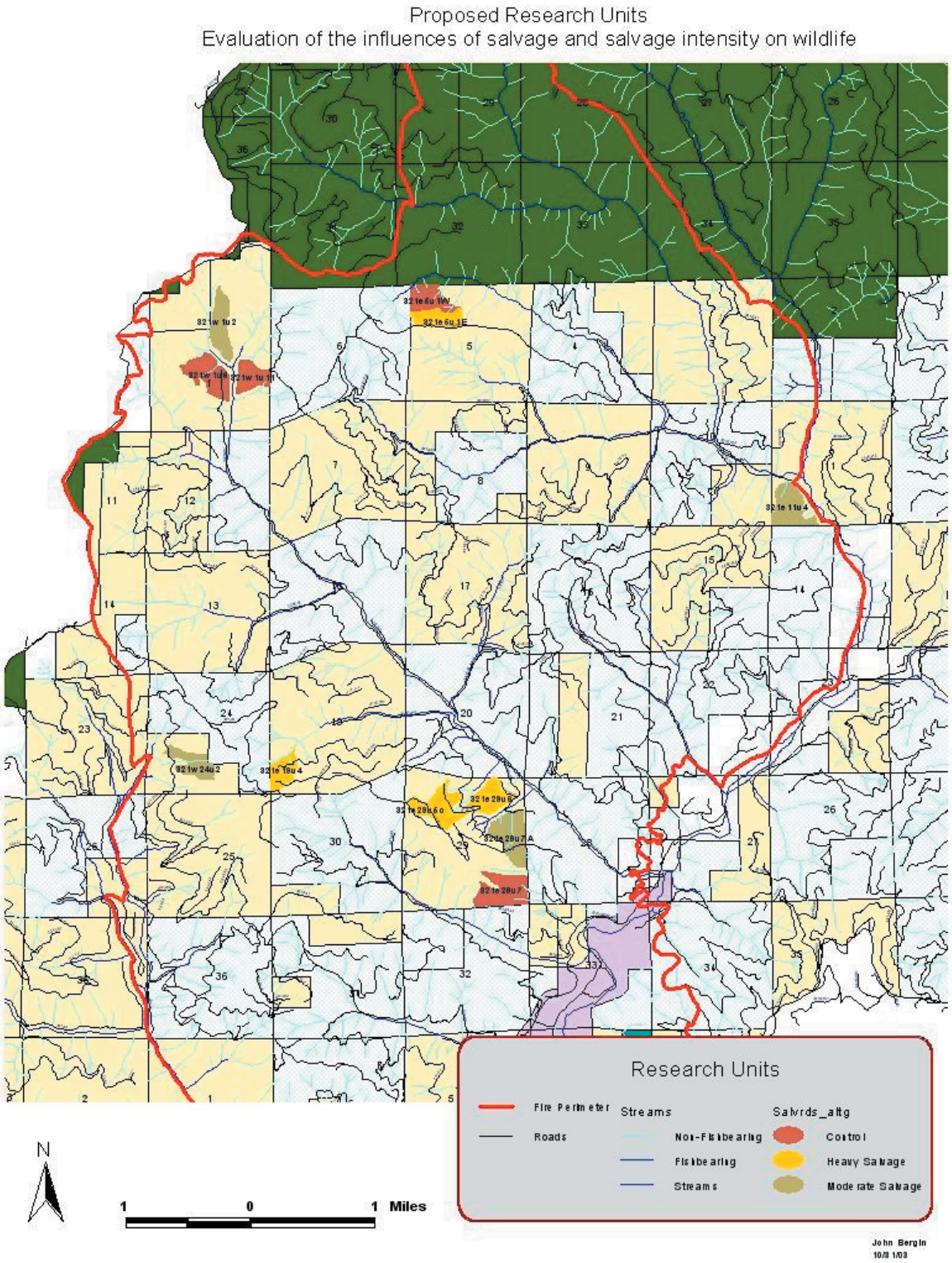

Figure 1. Location of research units.

Vegetation Dynamics and Fire Hazard in Experimental Mixed-species Restoration Plantings in Southwestern Oregon:

The Timbered Rock Fire
Butte Falls Resource Area, Medford BLM

A Research Proposal to the USDI Bureau of Land Management

by

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Vegetation Dynamics and Fire Hazard in Experimental Mixed-species Restoration Plantings in Southwestern Oregon:
The Timbered Rock Fire
Butte Falls Resource Area, Medford BLM

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Issue

Recent large-scale fire events have degraded functional characteristics of upland forests over extensive areas and placed at risk ecosystem stability, productivity, habitat, and water quality. Reforestation efforts are being considered to enhance development of forest communities that serve a broad spectrum of ecological functions and vary in temporal development with respect to fuels structure and fire risk. Mixed-species plantings have been increasingly employed since the mid-1980's as an adaptive management option and yet remain poorly documented in terms of stand development and, in particular, interactions among species of planted trees, as well as interactions among planted trees, natural tree regeneration, and associated shrub, herbaceous, and non-vascular vegetation. Further, there is a paucity of information regarding temporal and spatial dynamics of fuels structure and abundance in mixed-species plantations. Addressing these information gaps will provide managers with an improved understanding of the potential role of mixed-species plantings for meeting goals of ecosystem restoration and enhanced function, and for improving fuels hazard analyses and fuels management strategies.

Background:

Fire is a natural process driving structure and function of many Pacific Northwest forest ecosystems including those in southwestern Oregon (Agee 1993). Over the past several decades, disruption of natural fire cycles characterized by high frequency low intensity burns has resulted in forest structures characterized by high fuel loads and vertical and horizontal canopy distribution favorable for large-scale high intensity stand replacement fires.

Post-fire management objectives tend to focus on site stabilization, capture of potential merchantable wood, reforestation and minimization of risk for recurrent high-intensity fires. On federal lands in the Pacific Northwest these objectives are differentially considered in the contexts of various land allocations such as matrix, late-successional reserves, adaptive management areas, and riparian reserves. The suite of tools available for post-fire management is defined in part by Standards and Guidelines put forth in the Record of Decision guiding US Forest Service and US Bureau of Land Management planning (Anon. 1994).

Two post-fire management activities employed are salvage logging and reforestation. Each of these activities generates its own set of issues and controversy regarding the appropriateness of application. Proponents justify the implementation of salvage logging as a means to recover economic value and to decrease fuel loading by removing fire damaged logs and snags before the onset of decay. Reforestation is often undertaken with the objective of enhancing development of tree cover. Conflicts arise between different perspectives on the degree of environmental, economic and social risks and benefits associated with the implementation or lack of implementation of these practices (McIver and Starr 2000, eg. Beschta et al. 1995). Until the consequences of post-fire management practices are known with respect to a wide array of values these conflicts can not be fully addressed.

The ways in which salvage logging and reforestation are applied can possibly have substantial impact on stabilization of burned sites and the subsequent nature and rate of vegetation development. Given Standards and Guidelines defined in the ROD (1994), salvage logging may be an infrequent activity in many land allocations, while reforestation may have a broader range of implementation. The remainder of this discussion will focus primarily on reforestation and will address snag removal (salvage logging) as it directly relates to reforestation and vegetation dynamics. Artificial reforestation techniques have been developed largely in the context of economic forest management where rapid development of tree cover is a major goal (Hobbs 1992). As a result, our discussion of reforestation will draw largely upon knowledge gained from post-harvest reforestation efforts. We will address basic reforestation concepts with respect to natural regeneration as a baseline and with respect to fire as a disturbance.

Fire of intensity sufficient to cause extensive tree and shrub mortality reinitiates succession processes. The subsequent course of natural forest regeneration is determined by abundance and proximity of seed sources, seedbed characteristics, and the pre-burn presence and post-burn survival of sprouting species.

Natural regeneration of conifers is dependent upon seed and seedbed conditions suitable for germination and establishment of seedlings. Production of large seed crops varies by species with intervals ranging from 2-11 years for Douglas-fir, 3-9 years for white fir, and 2-8 years for ponderosa pine (USDA 1965). Fires may act as thinning agents in which large healthy canopy trees are released to produce greater seed crops within a few years following the burn. Conversely, trees experiencing severe fire damage may not respond to release in the near term. There is little information available on the effects of fire on seed production (Minore and Laake 1992).

Seed dispersal is predominantly driven by topography and wind. Dispersal abundance decreases exponentially with distance from the source tree (Hobbs et al. 1992). Dispersal distance tends to be greater from tall trees and for species with light seeds (eg. Douglas-fir) versus those with heavy seeds (eg. Sugar pine). These factors tend to result in high degrees of spatial and temporal variation in seed availability. In areas where all seed-bearing trees are killed or removed in salvage harvests, seed supply may be insufficient for conifer regeneration in the near term.

Typically, even low intensity fires alter the seedbed conditions by removing the duff and litter layers. Thus, after they have been leached by rain, seeds on moderately burned seedbeds showed higher germination success of Douglas-fir and white fir (Minore and Laake 1992). Conversely, on severely burned sites physical changes in soil conditions, such as reduced infiltration and percolation, increased pH, and reduced mycorrhizal associations, can greatly diminish seedbed quality. Darkening of the soil surface by charcoal residue can result in higher surface temperature that may stimulate seed germination in the spring but cause heat injury to the stems of young seedlings later in the growing season (Minore and Laake 1992). This is especially critical in the climate of southwest Oregon after overstory vegetation and shading slash have been removed by fires.

In contrast to conifers, several hardwood tree and shrub species can regenerate either by seed or vegetatively from stump or root sprouts (Tappeiner et al. 1992). Seeds of many woody shrubs species (eg. manzanita or ceanothus) accumulate and remain viable in the soil. Fire can stimulate germination of these seeds leading to a flush of new shrubs that can readily occupy site resources (Biswell 1989, Tappeiner et al. 1992). Further, fires of moderate intensity may consume the above-ground shrub canopy without causing mortality to the below-ground root system. Sprouts from the surviving stump and root system can often proliferate resulting in the rapid establishment of a vigorous shrub canopy (Biswell 1989). Abundant shrub development can severely inhibit conifer establishment and growth.

Because of the uncertainty associated with natural regeneration of conifers following fire, artificial reforestation, usually tree planting, is often undertaken in southwestern Oregon to establish conifers. Wildfires function as natural site preparation by killing competing vegetation and removing barriers to seedling development such as slash. However, as previously indicated, the wildfires may also serve to stimulate woody shrub seed banks and sprouting which on direr sites may be strongly competitive and a hindrance to planted seedling survival and growth (Helgerson et al. 1992).

Once seedlings are planted, weeding treatments may be required to ensure survival or growth, depending on management objectives and the current and anticipated development of competing vegetation. As germinants of competing species are not as vigorous as established plants, release treatments may be more effective after fires as compared to harvested or undisturbed sites. Alternatively, sprouting vegetation may reoccupy sites rapidly and even a short delay (e.g., to grow seedlings in a nursery or wait for a good seed crop) may lead to substantial limitations with crop tree survival and growth (Helgerson et al. 1992).

Residual live trees and fire-killed snags are often salvaged after a burn. The impacts of salvage harvest on reforestation efforts have not been explicitly addressed. The body of research effectively documenting impacts of salvage logging on site and vegetation development is very limited (McIver and Starr 2000). Specific impacts of salvage logging vary with a variety of factors, including pre-fire vegetation composition (especially presence of sprouting species), fire intensity, slope, soil texture, and post-fire and harvest weather conditions. Depending on the harvesting system used, salvage logging may influence regeneration through removing downed woody debris, by disturbing the soil surface to expose mineral soil or by disrupting impermeable hydrophobic layers in the soil. Salvage logging has also been shown to have at least some short-term influence on vegetation development as characterized by herb, shrub, and sapling abundance, by species diversity, and by vegetation biomass (McIver and Starr 2000). Compared to unlogged burned controls, areas that were post-fire salvage logged and subsequently broadcast burned had a higher coverage of hardwoods and these hardwoods inhibited the establishment and growth of Douglas-fir (Stuart et al. 1993). Additional disturbances of the logging process may also encourage establishment of native ruderal species and exotic invaders (Abrahamson 1984). In addition to site disturbance effects, salvage logging may also remove snags and woody shrub skeletons that provide shade and a mosaic of microsites in which harsh microclimatic conditions (temperature and evaporative demand) are moderated. Although there has been little explicit documentation of benefits of shade provided by snags, at least one study has demonstrated that shade from dead shrub canopies was beneficial to the survival and growth of

planted white fir on dry sites in California (Conard and Radosevich, 1982).

Long-term forest structure and species composition depend upon events that occur within the first few years after the fire. Helms and Tappeiner (1995) provide a qualitative model that fits the situation in southwest Oregon and illustrates this point. If no conifer seeds are available and shrub germinant or hardwood sprouts are dominant early on, the shrub/hardwood community may persist for many years. Eventually shade tolerant species may invade to form a pure stand after overtopping the shrubs and hardwoods. Alternatively, if seed is present or trees are planted, a more rapid development of a mixed conifer (shade intolerant and shade tolerant species) may take place. Delay of planting or seeding of intolerant species or failure to control competing shrubs after planting may result in development of a shrub/hardwood community or mixed true fir shrub/hardwood community. There are many possible variations of these themes that may occur at various scales and depending on seed dispersal, shrub and hardwood densities, etc.

As short-term changes in growing conditions are reflected in the long-term development of tree and shrub cover, they also impact future fire potential and behavior. The primary issues of concern are the potential for resetting of the successional process, thus delaying development of late-successional habitat, and potential changes to long-term site productivity induced by high severity fires. Post-fire management activities are aimed at reducing the amount of large wood on the site through salvage logging and accelerating the development of forest structures that are more resistant to fires through reforestation activities. Areas dominated by a dense shrub cover (e.g., ceanothus species) and young, dense plantations or natural stands are likely to be highly flammable. On the other hand, if trees establish and grow quickly, natural stand development will lead to lower density of (flammable) understory vegetation. Potential for crown fires is reduced once crown lift occurs and when tree crowns are spaced further apart (Graham et al. 1999). Subsequently, pre-commercial thinning and understory fuel treatments, such as shrub busting or prescribed burning, are commonly used to reduce the potential for future crown fires in these stands (Graham et al. 1999). Thus, rapid development of stands may reduce the time period when stands are highly susceptible to stand replacing fires by speeding up development towards forest structures with lower flammability (Graham et al. 1999).

Objectives:

The general objectives of this study are to evaluate mixed-species reforestation plantings to identify and characterize temporal patterns of vegetation structural development and species diversity; to assess temporal dynamics of fuels loading and fire risk; and to determine impacts of snag retention on survival and growth of planted and naturally regenerated trees.

Implicit in the generalized objectives stated above are short- and long-term research issues. For initial phases of stand development covered in this proposal, six specific research objectives include to determine effects of:

1) snag retention on the survival and establishment of planted seedlings by species,
2) planted seedling versus natural regeneration on tree survival and growth,
3) monoculture versus mixed-species plantings on planted seedling survival and growth,
4) planting density on survival and growth of planted seedlings by species, and site occupancy by planted and naturally regenerating trees, shrubs, and herbs,
5) weed control on planted seedling establishment and growth of trees, shrubs, and herbs, and
6) physiographic site conditions on planted seedling survival and growth of trees, shrubs, and herbs.

Research Approach:

A replicated field experiment will be conducted to evaluate reforestation by mixed-species plantings as influenced by planting density, woody vegetation removal, dead structure (fire-killed snag trees and shrubs), and physiographic site (harsh or moderate sites). Treatments for establishment of planted trees will be designed to reflect planting schemes that are being undertaken at broader, operational scales. Experimental plantings will be evaluated with respect to vegetation structure, plant diversity, fuels, fire risk, and tree mortality, stress, growth, and productivity. The degree of site and treatment control in the experimental plantings will permit a more explicit evaluation of treatment and site factors than obtainable from monitoring or retrospective analysis of operational mixed-species plantations being established by the BLM in the Elk Creek Watershed.

Treatments and Experiments:

Experimental factors will consist of species mix, planting density, woody vegetation removal (weeding), snag retention (salvage), and physiographic site. These factors will be tested as a modular experimental design. A basic set of six planting treatments varying in composition, density, and competing vegetation will be employed. Depending on specific research objectives listed above, differing numbers of the six basic treatment plots will be

established on harsh or moderate sites, or sites with or without snags.

The basic composition, density and weed treatments are:

Unplanted, not weeded (no woody vegetation removal)
Douglas-fir monoculture, weeded (woody vegetation removal through age 5)
Mixed species, 435 tpa (high density, 10' x10' spacing), not weeded
Mixed species, 435 tpa, weeded
Mixed species, 190 tpa (low density, 15' x 15' spacing), not weeded
Mixed species, 190 tpa, weeded

The basic treatment plot size is 1.5 ac (256' x 256') with the interior 1 ac (209' x 209') serving as the measurement plot.

In addition to the basic treatments listed above, physiographic site condition and snag retention will be included as experimental factors. Physiographic site conditions will be included through planting a subset of the six basic treatments on harsh and moderate sites as defined predominantly by aspect (southerly versus northerly), but also considering soil characteristics and slope position. Snag effects will be tested by planting a subset of the six basic treatments on sites with and without snags.

Three modular experiments are described below. Each module is designed to achieve statistical power for testing hypotheses specific to individual objectives. Each module will be analyzed separately, but all modules will have a subset of treatments in common to allow for limited interpretation of responses across modules.

Experiment A: Determine interactive effects of species composition, planting density, and weed control on seedling survival and early growth and site occupancy by planted seedlings and natural vegetation.

Objectives addressed: 2-5

Design: Five replications of the six basic treatments will be established on harsh sites with snags.

Rationale – This represents a base level test of the effects of species composition, planting density and weeding on plantation establishment and associated developmental responses of natural vegetation. Early responses, prior to tree canopy closure, represent individual tree and species responses to environmental heterogeneity. It is our assumption that salvage will not be the norm in fire restoration so this experiment will be conducted on sites with fire-killed snags. Conducting this experiment on harsh sites will result in an early expression of individual plant and species responses to the density and weed treatments.
Experiment A will be planted in 2004.

Experiment B: Determine effects of snags on survival and growth of planted seedlings.

Objectives addressed: 1

Design: Six replications of mixed species, high density, weeded treatments planted on harsh sites with and without snags.

Rationale: Snags will introduce microsite heterogeneity (light and possibly temperature and soil moisture modification). It is hypothesized that this microsite heterogeneity will result in different levels of mortality and early growth among planted tree species. Shrub skeletons and natural regeneration will be removed to provide an explicit test of the contribution by snags. Further, testing on harsh sites will result in an early expression of individual tree and species responses to snag moderation of microsite severity.
Experiment B will be planted in 2005.

Experiment C: Determine effects of physiographic site conditions on survival and growth of planted seedlings, and development of naturally regenerating herbs, shrubs and trees.

Objectives addressed: 1, 6

Design: Six replications of mixed species, high density, weeded and unweeded treatments; planted on harsh and moderate sites with snags.

Rationale: Resource availability and microclimate are influenced by physiographic site conditions and by competing vegetation. This experiment will permit differentiation of these two factors as they relate to seedling and species establishment. Snags will introduce additional microsite heterogeneity that will be exploited to differing degrees by different species of planted trees and naturally regenerating vegetation. Experiment C will be planted in 2004.

Experimental Layout:

Implementation of the three modular experiments will require 56 1.5-ac plots. Where common treatments exist among modules, individual plots will contribute to multiple experimental analyses. Allocation of plots to individual experiments and in terms of specific treatment conditions required are summarized in tables 1 and 2, respectively.

Experimental units will be identified in 2003 and randomly assigned treatments. Plot layout will occur in 2004. Plots used in Experiments A and C are not dependent upon salvage and will be planted in 2004. Plots used in Experiment B are dependent upon the completion of salvage and will be planted in 2005.

Table 1. Allocation of treatments by experiment. Note that acreage and plots totals across experiments will exceed the totals in Table 2 because some of the plots that receive treatments in common will be shared in multiple experiments.

Composition	Density (tpa)	Weeding	Site (aspect)	Salvage	# Plots	Acres (min.)
Experiment A (2004 Planting)						
No planting	0	Not weeded	Southerly	No salvage	5	7.5
Douglas-fir	435	Weeded	Southerly	No salvage	5	7.5
Mixed-sp.	435	Weeded	Southerly	No salvage	5	7.5
Mixed-sp.	435	Not weeded	Southerly	No salvage	5	7.5
Mixed-sp.	190	Weeded	Southerly	No salvage	5	7.5
Mixed-sp.	190	Not weeded	Southerly	No salvage	5	7.5
Experiment B (2005 Planting)						
Mixed-sp.	435	Weeded	Southerly	Salvage	6	9.0
Mixed-sp.	435	Weeded	Southerly	No salvage	6	9.0
Experiment C (2004 Planting)						
Mixed-sp.	435	Not weeded	Southerly	No salvage	6	9.0
Mixed-sp.	435	Weeded	Southerly	No salvage	6	9.0
Mixed-sp.	435	Not weeded	Northerly	No salvage	6	9.0
Mixed-sp.	435	Weeded	Northerly	No salvage	6	9.0

Table 2. Acreage requirement by treatment condition for experiments A-C, combined.

Composition	Density (tpa)	Weeding	Site (aspect)	Salvage	Planting Year	# Plots	Acres (min.)
No planting	0	Not weeded	Southerly	No salvage	2004	5	7.5
Douglas-fir	435	Weeded	Southerly	No salvage	2004	5	7.5
Mixed-sp.	435	Weeded	Southerly	No salvage	2004	6	9.0
Mixed-sp.	435	Not weeded	Southerly	No salvage	2004	6	9.0
Mixed-sp.	190	Weeded	Southerly	No salvage	2004	5	7.5
Mixed-sp.	190	Not weeded	Southerly	No salvage	2004	5	7.5
Mixed-sp.	435	Weeded	Northerly	No salvage	2004	6	9.0
Mixed-sp.	435	Not weeded	Northerly	No salvage	2004	6	9.0
Mixed-sp.	435	Weeded	Southerly	No salvage	2005	6	9.0
Mixed-sp.	435	Weeded	Southerly	Salvage	2005	6	9.0
Total						56	84

Additional Treatment Details

Species mixes will consist of planted seedlings of the conifers Douglas-fir, white fir, sugar pine, ponderosa pine and incense cedar; and hardwoods sprouts, mainly Pacific madrone and chinquapin oak. Douglas-fir will predominate in all settings, comprising up to 40% of the planted seedlings. At elevations in excess of 3500' white fir will be planted (10% of seedlings) and the proportion of Douglas-fir will be decreased to 30%. Sugar pine will constitute 20% of the seedlings at all sites. Ponderosa pine and/or incense cedar will contribute an additional 20% of the seedlings. A hardwood component will be included in the mixed-species plots by retaining a proportion of existing sprouts, principally Pacific madrone, and chinquapin oak. If originating as a clump, hardwood sprouts to be retained will be thinned to a single stem.

Removal of woody vegetation (weeding) on specified treatment plots will be achieved by manual cutting methods. The intent of vegetation removal is to facilitate the establishment of planted seedlings; not to provide for long-term maximum tree growth. Cutting will be done in summer after full leaf-out when root carbohydrate reserves are at a minimum. Vegetation removal treatments will be repeated in years 1, 2 and 4, and if needed in year 6, following salvage. After six years, planted seedlings should be established. Subsequent development of woody sprout and seedling development will be untreated.

Harsh and moderate physiographic sites will be identified based predominantly on aspect (northerly versus southerly), but also with consideration of soils (deep versus skeletal) and slope position (mid versus upper).

Response Variables

Response variables to be measured are listed below and classified as either basic or optional. Variables listed as basic are considered essential to meeting the basic objectives for characterizing stand development in terms of vegetation composition and structure; and in terms of fuels structure and fire hazard. Variables listed as optional represent additional opportunities to address basic questions of ecosystem structure, function, and process that would be considered by the principal investigators if they obtain external funding to do so, or cooperators are identified who are willing to undertake these issues.

Basic

- Plant species richness – species list
- Planted tree survival - by species
- Planted tree growth – height, diameter
- Natural tree regeneration density – by species
- Natural tree regeneration growth – height, diameter
- Woody shrub density – by species
- Woody shrub cover – by species
- Woody shrub height and diameter – by species
- Herbaceous species cover – by species
- Snag height and density – by species and diameter class
- Coarse woody debris abundance – by species and diameter class
- Fuels profiles – biomass by combustion class

Optional

- Non-vascular plant species richness
- Non-vascular plant species abundance
- Planted tree leaf area – by species
- Planted tree biomass – by species
- Woody shrub leaf area – by species
- Woody shrub biomass – by species
- Canopy leaf area
- Canopy biomass
- Soil moisture status
- Soil and air temperature profiles
- Planted tree water relations
- Woody shrub water relations
- Planted tree rooting density
- Woody shrub rooting density
- Soil nutrient status
- Foliage nutrient status

Deliverables

Products of the proposed project for delivery to the BLM will include annual progress reports, including preliminary analysis of all vegetation, CWD, and fuels data as generated in years 1-3, and 5; a detailed report of findings in year 4 (covering years 1-3); and a detailed report of findings in year 6 (covering years 1-5).

In addition to the reports to be delivered to the BLM, it is anticipated that the proposed research will yield 1 or 2 Master's theses, a PhD dissertation, and 4-6 peer-reviewed journal articles in the first 6 years following establishment.

Findings will be presented to BLM personnel and at regional and national meetings as opportunities arise.

Partners, Roles and Responsibilities

USFS PNW – Paul D. Anderson, Principal Investigator

- Primary contact, facilitator and coordinator among primary BLM, OSU, and PNW partners
- Establishment of study including treatment and sampling plot layouts
- Primary collection of first year vegetation data
- Collaborator on vegetation data collection, analysis, interpretation, and reporting in years 2 through 6
- Database management and data quality assurance
- Co-advisor of student researchers
- Facilitation and coordination of potential research collaborators and partners
- Advocacy and solicitation for supplemental funding

OSU – Klaus Puettmann, John Tappeiner, Co-principal Investigators

- Primary collection of vegetation data years 2 through 6
- Collaborators on vegetation data collection, analysis, interpretation, and reporting in years 2 through 6
- Recruitment and principal advising of two graduate student researchers
- Advocacy and solicitation for supplemental funding

US BLM – Butte Falls Resource Area

- Advice on study scope, design and implementation
- Provision of study sites
- Purchase of planting stock
- Planting of experimental plots
- Vegetation control for weeding treatments
- Cutting of snags and removal of woody skeletons
- Facilitation of the long-term integrity of study plots
- Potential collaborator on supplemental data collection or research issues
- Potential collaborator on data interpretation and application of results
- Advocacy for supplemental funding

Project Schedule

This proposal explicitly covers activities through 2009. The timing of specific activities is summarized in Table 3. Progress reports will be written annually. Comprehensive analyses and reporting will be done following the third and fifth years after planting. Research activity beyond the fifth-year following planting is anticipated with intermediate- and long-term objectives to be addressed in future proposals and study plans.

Table 3. Schedule of research activities. Letters A, B and C refer to the corresponding experiments. Shaded cells refer to planned activities beyond the scope of this proposal. Beyond year 10, it is anticipated that data collection will occur at five-to-ten-year intervals throughout stand development.

Activity	'03	'04	'05	'06	'07	'08	'09	'10	'11	'13	'14
Establishment/Maintenance											
Experimental unit selection	A B C										
Plot establishment		A C	B								
Planting		A C	B								
Weeding		A C	A C B	B	A C	B	A C	B			
Data Collection											
Plant species richness		A C	A C B	A C B	B	A C	B	A C	B	A C	B
Planted seedling survival		A C	A C B	A C B	B	A C	B	A C	B	A C	B
Planted seedling ht. & diam.		A C	A C B	A C B	B	A C	B	A C	B	A C	B
Natural seedling density		A C	A C B	A C B	B	A C	B	A C	B	A C	B
Natural seedling ht. & diam.		A C	A C B	A C B	B	A C	B	A C	B	A C	B
Shrub density		A C	A C B	A C B	B	A C	B	A C	B	A C	B
Shrub cover		A C	A C B	A C B	B	A C	B	A C	B	A C	B
Shrub volume		A C	A C B	A C B	B	A C	B	A C	B	A C	B
Herbaceous cover		A C	A C B	A C B	B	A C	B	A C	B	A C	B
Snag density		A C	B	A C B	B	A C	B	A C	B	A C	B
Coarse woody debris		A C	B	A C B	B	A C	B	A C	B	A C	B
Fuels		A C	B	A C B	B	A C	B	A C	B	A C	B
Analysis, Reporting			A C	B	A C	B	A C B				

A – effects of species composition, density, and weed control on vegetation dynamics
B – effect of snag retention on vegetation dynamics
C – effects of edaphic site and weed control on vegetation dynamics
Weeding will be done in mid-summer
Herbaceous data will be collected in summer
Tree, shrub, snag, coarse woody debris and fuels data will be collected in the autumn

Estimated Costs

The total proposal budget request to the BLM for the 6-years of project funding is $415,600. These funds are distributed to OSU and PNW in the amounts of $280.4 K to Oregon State University and $135.2 K to PNW. In addition it is anticipated that the BLM will provide vegetation seedling stock, planting, and vegetation and snag removal funds through their operational management activity budgets estimated to total $40 K.
PNW and OSU in-kind contributions (Prinicipal Investigator salaries and PNW Corvallis laboratory indirect costs) total $96.3 K by PNW and $184.3 K by OSU (64.6 K as reduced overhead rate contribution, 119.7 K as in-kind salary). Respectively, this represents a cost-share of 42% by PNW and 66% by OSU, relative to the proposed funding to be received by the two research institutions.

The proposed budget, summarized annually and for the entire 6-year project is presented in Table 4. Detailed individual budgets for PNW and OSU are also available.

Table 4. Annual and total project cost estimates summarized by research institution assuming measurement of the basic response variables.

	Funding Year						
	FY04	**FY05**	**FY06**	**FY07**	**FY08**	**FY09**	**Overall**
Direct Costs							
Salaries and Benefits							
Oregon State University	$5,760	$23,619	$42,869	$25,038	$25,790	$20,811	$143,888
USFS PNW	$18,598	$6,712	$7,047	$4,431	$7,770	$4,886	$49,443
Research Assistant Tuition/Fees							
Oregon State University	$0	$9,273	$19,789	$10,314	$10,755	$11,495	$61,627
Travel							
Oregon State University	$3,000	$4,000	$7,000	$5,200	$4,000	$2,950	$26,150
USFS PNW	$17,070	$7,686	$7,686	$7,686	$7,686	$7,686	$55,500
Other Direct Costs							
Oregon State University	$0	$2,200	$2,800	$2,200	$1,900	$3,100	$12,200
USFS PNW	$1,500	$1,450	$750	$1,500	$1,450	$1,500	$8,150
Total Direct							
Oregon State University	$8,760	$39,092	$72,458	$42,752	$42,445	$38,357	$243,864
USFS PNW	$37,168	$15,848	$15,483	$13,617	$16,906	$14,072	$113,093
Indirect/Overhead							
Oregon State University	$1,314	$5,864	$10,869	$6,413	$6,367	$5,754	$36,580
USFS PNW	$7,248	$3,090	$3,019	$2,655	$3,297	$2,744	$22,053
TOTAL Request							
Oregon State University	$10,075	$44,956	$83,327	$49,165	$48,812	$44,110	$280,444
USFS PNW	$44,416	$18,938	$18,502	$16,273	$20,202	$16,816	$135,146
Annual Totals	**$54,490**	**$63,894**	**$101,829**	**$65,438**	**$69,014**	**$60,926**	
Project Total							**$415,591**
In-kind Contributions							
Direct Costs							
PI Salary - OSU KP (0.07* FTE)	$4,204	$11,083	$11,686	$12,319	$12,984	$13,682	$65,959
PI Salary – OSU JT (0.10 FTE)	$4,500	$9,270	$9,548	$9,835	$10,130	$10,433	$53,716
PI Salary - PNW PA (0.12 FTE)	$9,840	$10,332	$10,849	$11,391	$11,961	$12,559	$66,931
Indirect Costs							
OSU Overhead Reduction	$2,321	$10,359	$19,201	$11,329	$11,248	$10,165	$64,624
PNW CFSL Charge	$10,660	$4,160	$4,160	$3,120	$4,160	$3,120	$29,380
Annual Totals	**$31,525**	**$45,204**	**$55,444**	**$47,994**	**$50,482**	**$49,959**	
Project Total							**$280,608**

*** For budget year 2003 FTE is 0.04.**

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Scientist Biographies

Robert E. Gresswell received degrees from the University of New Mexico (BS), Utah State University (MS), and Oregon State University (PhD). Since 1997, Bob has been working as an aquatic ecologist for the USGS Forest and Rangeland Ecosystem Science Center and the CFER Program. He is also a courtesy assistant professor with the Department of Fisheries and Wildlife at Oregon State University. His interests concerning the influence of land-use activities on forested ecosystems have led to research on the relationships among landscape-scale environmental features, instream habitat characteristics, and coastal cutthroat trout abundance and distribution in watersheds in western Oregon.

John P. Hayes is program coordinator and a wildlife ecologist for the CFER program. He also serves as an associate professor in the Department of Forest Science at Oregon State University where he teaches coursework in forestry-wildlife interactions. John received his BS in Wildlife Science at Oregon State University, his MS in Biology at Southern Oregon State College, and his PhD in Ecology and Evolutionary Biology at Cornell University. His research interests include the influence of forest management on wildlife populations, the influence of spatial scale on habitat selection, and the ecology and management of bats.

Steven Perakis joined the CFER research team as a research ecologist with the USGS Forest and Rangeland Ecosystem Science Center. Steve's research centers on understanding biogeochemical cycles in terrestrial ecosystems, and he has particular interest in discerning how processes and activities within forests shape nutrient losses, whole-system nutrient balances, and linkages between terrestrial and aquatic ecosystems. Steve has degrees in Ecology and Ecosystem Science from the University of Pennsylvania (BS), University of Washington (MS), and Cornell University (PhD), with a year of post-doctoral experience from Stanford University. He also holds a courtesy appointment in the Department of Forest Science at Oregon State University.

Janet Erickson is the information exchange specialist for the CFER program. She is responsible for conveying information about the CFER program and its research projects to land managers and other audiences. She develops and manages the production of a variety of information products, such as the CFER web site, written publications, videos, displays, field tours, and symposia. Janet received her BS in Biology from Pacific Lutheran University and her MS and PhD in Wildlife Science from the University of Washington.

Michelle Donaghy Cannon is a PhD student in the Department of Forest Science and the Department of Fisheries and Wildlife. She is studying the influence of woody plant community composition in riparian areas on birds.

John Cissel is the BLM Western Oregon Science Liaison stationed in the Forestry Sciences Laboratory at Oregon State University. John's role is to help connect the western Oregon BLM districts to science by integrating management needs into research projects, developing management studies to address management questions, sharing recent science findings with managers, and by developing and demonstrating applications of new science concepts and findings. John has a BS in Forestry from Michigan State University, MS in Forest Management and Operations Research from Penn State University, and has completed additional coursework in forest ecology at Oregon State University. He also holds a courtesy appointment in the Department of Forest Science at Oregon State University.

Dr. Paul D. Anderson current position is a Supervisory Research Forester, Team Leader of the Biology and Culture of Forest Plants Team in the Resource Management and Productivity Program for the USDA Forest Service, Pacific Northwest Research Station Corvallis, OR. His areas of expertise include Ecological Plant Physiology and Silviculture. His research interests include physiological and ecological foundations of silviculture, forest and wildland restoration, plant genecology and forest response to climate change. He received a PhD in Ecophysiology and Silviculture at the Department of Forest Resources, University of California, Berkeley, 1991; MSF in Silviculture and Forest Soils, Department of Forestry and Natural Resources, Purdue University, 1981; and BS in Forest Ecology and Silviculture, College of Forestry, University of Minnesota, 1979. Previous Positions include Research Associate, Silviculture and Ecophysiology, University of Minnesota Aspen and Larch Genetics Cooperative, 2000 – 2002; Research Plant Physiologist, USDA Forest Service, North Central Research Station, 1993- 2000; Adjunct Professor, Department of Biological Sciences, California State University, Chico, 1993-1995; Research Associate, Forest Ecophysiology, University of California, Berkeley, 1992-1993; Research Associate, Forest Ecophysiology, California State University Chico/Lawrence Livermore National Laboratory, 1991-1992; Research Associate, Forest Ecophysiology, Environmental Sciences Division, Lawrence Livermore National Laboratory, 1988-1991; Research/Teaching Assistant, Silviculture, Mensuration, Forest Ecophysiology, University of California at Berkeley, 1982-1988; Research/Teaching Assistant, Silviculture, Purdue University, 1979-1981.

Klaus Puettmann is an Associate Professor Department of Forest Science, Oregon State University. His research interests are in Silviculture and forest ecology – natural and artificial regeneration, dynamics of plant interactions and management of diverse stand structures. He received a PhD in (Silviculture, Forest Modeling), 1990 Oregon State University, Corvallis, Oregon and a Diplom-Forstwirt in Forstwissenschaft (Forest Science), 1986, Albert Ludwigs Universitaet, Freiburg, Germany.

Appendix H
Soils

RUSLE Related Attributes

Jackson County Area, Oregon, Parts Of Jackson And Klamath Counties

Map Unit Symbol and Map Unit Name	% Composition	Component	Hydrologic Group	Kw	T Factor	Representative Value		
						% Sand	% Silt	% Clay
23A: Camas-newberg-evans complex, 0 to 3 percent slopes	40	Camas	A	.10	2	68.5	24.0	7.5
	30	Newberg	B	.28	3	62.8	26.2	11.0
	19	Evans	B	.32	5	44.3	40.7	15.0
63E: Freezener gravelly loam, 12 to 35 percent north slopes	85	Freezener	B	.20	5	39.2	37.3	23.5
64E: Freezener gravelly loam, 12 to 35 percent south slopes	85	Freezener	B	.20	5	39.2	37.3	23.5
66E: Freezener-geppert complex, 12 to 35 percent north slopes	65	Freezener	B	.20	5	39.2	37.3	23.5
	30	Geppert	C	.10	3	39.8	37.7	22.5
66G: Freezener-geppert complex, 35 to 60 percent north slopes	65	Freezener	B	.20	5	39.2	37.3	23.5
	27	Geppert	C	.10	3	39.8	37.7	22.5
67G: Freezener-geppert complex, 35 to 60 percent south slopes	65	Freezener	B	.20	5	39.2	37.3	23.5
	27	Geppert	C	.10	3	39.8	37.7	22.5
111G: Momullin-monull gravelly loams, 35 to 60 percent south slopes	60	Momullin	D	.17	1	42.1	37.9	20.0
	25	Monull	C	.17	3	39.2	37.3	23.5

USDA Natural Resources Conservation Service

Distribution Generation Date: 10/1/02

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RUSLE Related Attributes - Continued

Jackson County Area, Oregon, Parts Of Jackson And Klamath Counties

Map Unit Symbol and Map Unit Name	% Composition	Component	Hydrologic Group	Kw	T Factor	Representative Value		
						% Sand	% Silt	% Clay
113E: Momullin-rock outcrop complex, 3 to 35 percent slopes	60	Momullin	D	.17	1	42.1	37.9	20.0
	25	Rock Outcrop	---	---	---	---	---	---
113G: Momullin-rock outcrop complex, 35 to 60 percent slopes	60	Momullin	D	.17	1	42.1	37.9	20.0
	29	Rock Outcrop	---	---	---	---	---	---
114E: Mcnull loam, 12 to 35 percent north slopes	80	Mcnull	C	.24	3	39.2	37.3	23.5
114G: Mcnull loam, 35 to 60 percent north slopes	80	Mcnull	C	.24	3	39.2	37.3	23.5
115E: Mcnull gravelly loam, 12 to 35 percent south slopes	80	Mcnull	C	.17	3	39.2	37.3	23.5
115G: Mcnull gravelly loam, 35 to 60 percent south slopes	80	Mcnull	C	.17	3	39.2	37.3	23.5
116E: Mcnull-momullin gravelly loams, 12 to 35 percent south slopes	55	Mcnull	C	.17	3	39.2	37.3	23.5
	30	Momullin	D	.17	1	42.1	37.9	20.0
116G: Mcnull-momullin gravelly loams, 35 to 60 percent south slopes	55	Mcnull	C	.17	3	39.2	37.3	23.5
	30	Momullin	D	.17	1	42.1	37.9	20.0

USDA Natural Resources Conservation Service

Distribution Generation Date: 10/1/02

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RUSLE Related Attributes - Continued

Jackson County Area, Oregon, Parts Of Jackson And Klamath Counties

Map Unit Symbol and Map Unit Name	% Composition	Component	Hydrologic Group	Kw	T Factor	Representative Value		
						% Sand	% Silt	% Clay
117G: Mcnull-mcmullin complex, 35 to 60 percent north slopes	55	Mcnull	C	.24	3	39.2	37.3	23.5
	30	Mcmullin	D	.17	1	42.1	37.9	20.0
118E: Mcnull-medco complex, 12 to 50 percent slopes	55	Mcnull	C	.17	3	39.2	37.3	23.5
	35	Medco	D	.10	3	35.4	33.6	31.0
119F: Mcnull-medco complex, high precipitation, 12 to 50 percent slopes	50	Mcnull	C	.24	3	39.2	37.3	23.5
	35	Medco	D	.24	3	35.4	33.6	31.0
124F: Medco clay loam, high precipitation, 12 to 50 percent south slopes	80	Medco	D	.28	3	35.4	33.6	31.0
125F: Medco-mcmullin complex, 12 to 50 percent slopes	50	Medco	D	.10	3	35.4	33.6	31.0
	30	Mcmullin	D	.17	1	42.1	37.9	20.0
126F: Medco-mcnull complex, 12 to 50 percent slopes	55	Medco	D	.10	3	35.4	33.6	31.0
	30	Mcnull	C	.24	3	39.2	37.3	23.5
163A: Sevenoaks loamy sand, 0 to 3 percent slopes	85	Sevenoaks	A	.05	5	81.1	16.4	2.5
183E: Straight extremely gravelly loam, 12 to 35 percent south slopes	80	Straight	C	.05	3	39.8	37.7	22.5

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RUSLE Related Attributes - Continued

Jackson County Area, Oregon, Parts Of Jackson And Klamath Counties

Map Unit Symbol and Map Unit Name	% Composition	Component	Hydrologic Group	Kw	T Factor	Representative Value		
						% Sand	% Silt	% Clay
184G: Straight-shippa extremely gravelly loams, 35 to 70 percent north slopes	60	Straight	C	.05	3	39.8	37.7	22.5
	20	Shippa	D	.05	1	39.8	37.7	22.5
185G: Straight-shippa extremely gravelly loams, 35 to 60 percent south slopes	55	Straight	C	.05	3	39.8	37.7	22.5
	25	Shippa	D	.05	1	39.8	37.7	22.5
187A: Takilma cobbly loam, 0 to 3 percent slopes	85	Takilma	B	.17	5	42.7	38.3	19.0

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Timbered Rock EIS
Soils Concerns on BLM Administered Lands

Soil #	Soil Name	Hydro Logic Group see end of table	Ordination Symbol defined end of table	Erosion Hazard see end of table	Equipment Limitations	Seedling Mortality Concerns	Wind Throw Hazard	High Burn Severity Acres	Low Burn Severity Acres	Mod Burn Severity Acres	Very Low Burn Severity Acres	Total
23A	**Camas-Newberg-Evans Complex,** 0 To 3 Percent Slopes	A + B	11S	Slight	Slight	Mod	Slight		4	2	3	9
63E	**Freezener Gravelly Loam,** 12 To 35 Percent North Slopes	B	10R	Slight	Mod	Slight	Slight	57	47	52	85	241
64E	**Freezener Gravelly Loam,** 12 To 35 Percent South Slopes	B	8R	Slight	Mod	Mod	Slight	35	149	55	169	407
66E	**Freezener-Geppert Complex,** 12 To 35 Percent North Slopes	B + C	6F + 10R	Slight	Mod	Slight - Mod	Slight - Mod	8	1	17		26
66G	**Freezener-Geppert Complex,** 35 To 60 Percent North Slopes	B + C	6F + 10R	Mod	Severe	Slight - Mod	Slight - Mod	254	223	236	258	972
67G	**Freezener-Geppert Complex,** 35 To 60 Percent South Slopes	B + C	10R	Mod	Severe	Severe	Slight - Mod	131	464	283	394	1272
111G	**Mcmullin-Mcnull Gravelly Loams,** 35 To 60 Percent South Slopes	C +D	6R	Mod	Severe	Severe	Mod		40	66	2	107
113E	**Mcmullin Rock Outcrops,** 3- 35 Percent Slopes	Not Rated By The Natural Resources Conservation Service							16	10	1	28
113G	**Mcmullin Rock Outcrops,** 35 - 60 Percent Slopes	Not Rated By The Natural Resources Conservation Service						42	292	341	109	784
114E	**Mcnull Loam,** 12 To 35 Percent North Slopes	C	6D	Mod	Mod	Slight	Mod	5	16	18	1	40
114G	**Mcnull Loam,** 35 To 60 Percent North Slopes	C	6R	Mod	Severe	Slight	Mod	2	88	49	114	253
115E	**Mcnull Gravelly Loam,** 12 To 35 Percent South Slopes	C	6R	Mod	Mod	Mod	Mod		11	9	12	32
115G	**Mcnull Gravelly Loam,** 35 To 60 Percent South Slopes	C	6R	Mod	Severe	Severe	Mod		16	23		39
116E	**Mcnull-Mcmullin Gravelly Loams,** 12 To 35 Percent South Slopes	C + D	6R	Mod	Mod	Mod	Mod	20	1	5		26
116G	**Mcnull-Mcmullin Gravelly Loams,** 35 To 60 Percent South Slopes	C + D	6R	Mod	Severe	Severe	Mod	14	14	20	15	63
117G	**Mcnull-Mcmullin Complex,** 35 To 60 Percent North Slopes	C + D	6R	Mod	Severe	Slight	Mod	13	24	20	47	104
118E	**Mcnull-Medco Complex,** 12 To 50 Percent Slopes	C + D	6R	Mod	Mod	Mod	Mod	0	40	9	7	56

Timbered Rock EIS
Soils Concerns on BLM Administered Lands

Soil #	Soil Name	Hydro Logic Group see end of table	Ordination Symbol defined end of table	Erosion Hazard see end of table	Equipment Limitations	Seedling Mortality Concerns	Wind Throw Hazard	High Burn Severity Acres	Low Burn Severity Acres	Mod Burn Severity Acres	Very Low Burn Severity Acres	Total
119F	**Mcnull-Medco Complex,** High pptn, 12 To 50 Percent Slopes	C + D	5W + 6R	Mod	Mod - Severe	Mod	Mod - Severe	2	29	14	6	51
124F	**Medco Clay Loam,** High pptn, 12 To 50 Percent South Slopes	D	5W	Mod	Severe	Mod	Severe			9	0	10
125F	**Medco-Mcmullin Complex,** 12 To 50 Percent Slopes	Not Rated By The Natural Resources Conservation Service							2	1		3
126F	**Medco-Mcnull Complex,** 12 To 50 Percent Slopes	C + D	6R	Mod	Mod	Mod	Mod	0	60	34	10	104
163A	**Sevenoaks Loamy Sand,** 0 To 3 Percent Slopes	Not Rated By The Natural Resources Conservation Service									0	0
183E	**Straight Extremely Gravelly Loam,** 12 To 35 Percent South Slopes	C	9F	Slight	Mod	Severe	Mod	9	110	23	79	221
184G	**Straight-Shippa Extremely Gravelly Loams,** 35 To 70 Percent North Slopes	C + D	9R	Mod	Severe	Mod	Mod - Severe	210	1121	695	1131	3156
185G	**Straight-Shippa Extremely Gravelly Loams,** 35 To 60 Percent South Slopes	C + D	9R	Mod	Severe	Severe	Mod - Severe	185	1358	700	1274	3517
187A	**Takilma Cobbly Loam,** 0 To 3 Percent Slopes	Not Rated By The Natural Resources Conservation Service									0	0
							Total Acres	986	4121	2693	3718	11518
							Percents	9	36	23	32	100

Ordination Symbol Consists Of Two Parts, A Number And A Letter.

The Number Refers To Productivity Class

I.E., Potential Productivity In Terms Of Cubic Meters Of Wood Per Hectare Per Year For Pines Or Firs.

The Letter Is An Indicator Of Potential Problems As Defined

D	Restricted Rooting Depth	W	Excessive Wetness
F	Fragmental Or Skeletal Soils	S	Sandy
R	Relief Or Slope Steepness		

Erosion Hazard Relates To The Ease Of Detachment And Movement Of Soil And Rock Particles, It Is Not Meant To Imply That This Material Has Entered The Aquatic Environment, But Rather The Colluvial Environment Where It Could Remain For Years To Millennia. Almost All Soils On Hillslopes Form In Colluvium.

Hydrologic Group - Used To Estimate Runoff From Precipitation When Soils Are Thouroghly Wet And Vegetative Cover Is Removed.

A = High Infiltration Rate, D = Very Slow Infiltration Rate

Table FOR-5. - Forestland Management

Jackson County Area, Oregon, Parts Of Jackson And Klamath Counties

The information in this table indicates the dominant soil condition, but does not eliminate the need for onsite investigation. The numbers in the value column range from 0.01 to 1.00. The larger the value, the greater the potential limitation. Limiting features in this report are limited to the top 5 limitations. Additional limitations may exist.

Map Symbol and Soil Name	Pct of Map Unit	Potential for Damage to Soil by Fire		Potential for Seedling Mortality	
		Rating Class and Limiting Features	Value	Rating Class and Limiting Features	Value
23A:					
Camas	40	Low		Low	
		Texture/coarse fragments	0.10		
Newberg	30	Low		Low	
		Texture/coarse fragments	0.10		
Evans	19	Low		Low	
		Texture/coarse fragments	0.10		
63E:					
Freezener	85	Low		Low	
		Texture/coarse fragments	0.10		
64E:					
Freezener	85	Low		Low	
		Texture/coarse fragments	0.10		
66E:					
Freezener	65	Low		Low	
		Texture/coarse fragments	0.10		
Geppert	30	Low		Low	
		Texture/coarse fragments	0.10		
66G:					
Freezener	65	Low		Low	
		Texture/coarse fragments	0.10		
Geppert	27	Low		Low	
		Texture/coarse fragments	0.10		
67G:					
Freezener	65	Low		Low	
		Texture/coarse fragments	0.10		
Geppert	27	Moderate		Low	
		Texture/coarse fragments	0.50		

Table FOR-5. - Forestland Management - Continued

Jackson County Area, Oregon, Parts Of Jackson And Klamath Counties

Map Symbol and Soil Name	Pct of Map Unit	Potential for Damage to Soil by Fire		Potential for Seedling Mortality	
		Rating Class and Limiting Features	Value	Rating Class and Limiting Features	Value
111G:					
Mcmullin	60	Low		Low	
Mcnull	25	Low		Low	
113E:					
Mcmullin	60	Low		Low	
		Texture/coarse fragments	0.10		
Rock Outcrop	25	High		High	
		Horizon table contains no data	1.00	Horizon table contains no data	1.00
		Texture/coarse fragments	1.00	Soil reaction	1.00
		Texture/surface depth/coarse fragments	1.00		
113G:					
Mcmullin	60	Low		Low	
Rock Outcrop	29	High		High	
		Horizon table contains no data	1.00	Horizon table contains no data	1.00
		Texture/coarse fragments	1.00	Soil reaction	1.00
		Texture/surface depth/coarse fragments	1.00		
114E:					
Mcnull	80	Low		Low	
		Texture/coarse fragments	0.10		
114G:					
Mcnull	80	Low		Low	
		Texture/slope/coarse fragments	0.10		
115E:					
Mcnull	80	Low		Low	
		Texture/coarse fragments	0.10		
115G:					
Mcnull	80	Low		Low	
116E:					

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Table FOR-5. - Forestland Management - Continued

Jackson County Area, Oregon, Parts Of Jackson And Klamath Counties

Map Symbol and Soil Name	Pct of Map Unit	Potential for Damage to Soil by Fire		Potential for Seedling Mortality	
		Rating Class and Limiting Features	Value	Rating Class and Limiting Features	Value
116E:					
Mcnull	55	Low		Low	
		Texture/coarse fragments	0.10		
Mcmullin	30	Low		Low	
		Texture/coarse fragments	0.10		
116G:					
Mcnull	55	Low		Low	
Mcmullin	30	Low		Low	
117G:					
Mcnull	55	Low		Low	
		Texture/slope/coarse fragments	0.10		
Mcmullin	30	Low		Low	
118E:					
Mcnull	55	Low		Low	
Medco	35	Low		High	
				Wetness	1.00
119F:					
Mcnull	50	Low		Low	
Medco	35	Low		High	
				Wetness	1.00
124F:					
Medco	80	Low		High	
				Wetness	1.00
125F:					
Medco	50	Low		High	
				Wetness	1.00
Mcmullin	30	Low		Low	
126F:					
Medco	55	Low		High	
				Wetness	1.00
Mcnull	30	Low		Low	
163A:					

Table FOR-5. - Forestland Management - Continued

Jackson County Area, Oregon, Parts Of Jackson And Klamath Counties

Map Symbol and Soil Name	Pct of Map Unit	Potential for Damage to Soil by Fire		Potential for Seedling Mortality	
		Rating Class and Limiting Features	Value	Rating Class and Limiting Features	Value
163A:					
Sevenoaks	85	Moderate		Low	
		Texture/coarse fragments	0.50		
183E:					
Straight	80	Moderate		Low	
		Texture/coarse fragments	0.50		
184G:					
Straight	60	Moderate		Low	
		Texture/coarse fragments	0.50		
Shippa	20	Moderate		Low	
		Texture/slope/surface depth/coarse fragments	0.50		
185G:					
Straight	55	Moderate		Low	
		Texture/coarse fragments	0.50		
Shippa	25	High		Low	
		Texture/slope/surface depth/coarse fragments	1.00		
187A:					
Takilma	85	Low		Low	
		Texture/coarse fragments	0.10		

Table J1b. - Physical Properties of the Soils

Jackson County Area, Oregon, Parts Of Jackson And Klamath Counties

Entries under "Erosion Factors--T" apply to the entire profile. Entries under "Wind Erodibility Group" and "Wind Erodibility Index" apply only to the surface layer. Absence of an entry indicates that data were not estimated.

Map Symbol and Soil Name	Depth	Sand	Silt	Clay	Moist Bulk Density	Permeability (Ksat)	Available Water Capacity	Linear Extensi-bility	Organic Matter	Erosion Factors			Wind Erodi-bility Group	Wind Erodi-bility Index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/Hr	In/In	Pct	Pct					
23A:														
Camas	0-10	---	---	5-10	1.30-1.50	2-6	0.07-0.09	0.0-2.9	1.0-3.0	.10	.20	2	3	86
	10-60	---	---	0-5	1.40-1.60	20-100	0.03-0.05	0.0-2.9	0.0-1.0	.02	.10			
Newberg	0-17	---	---	7-15	1.20-1.40	2-6	0.12-0.15	0.0-2.9	2.0-4.0	.28	.28	3	3	86
	17-30	---	---	5-15	1.20-1.40	2-6	0.12-0.15	0.0-2.9	0.5-1.0	.24	.28			
	30-60	---	---	2-10	1.20-1.40	6-20	0.09-0.13	0.0-2.9	0.2-1.0	.10	.20			
Evans	0-38	---	---	12-18	1.35-1.50	0.6-2	0.16-0.20	0.0-2.9	2.0-5.0	.32	.32	5	5	56
	38-60	---	---	10-18	1.40-1.55	0.6-2	0.13-0.23	0.0-2.9	0.1-2.0	.43	.43			
63E:														
Freezener	0-9	---	---	20-27	1.20-1.30	0.6-2	0.13-0.16	0.0-2.9	2.0-4.0	.20	.28	5	7	38
	9-18	---	---	27-45	1.20-1.30	0.6-2	0.18-0.21	0.0-2.9	1.0-3.0	.28	.28			
	18-60	---	---	35-50	1.20-1.40	0.2-0.6	0.13-0.16	3.0-5.9	0.5-1.0	.28	.37			
64E:														
Freezener	0-9	---	---	20-27	1.20-1.30	0.6-2	0.13-0.16	0.0-2.9	2.0-4.0	.20	.28	5	7	38
	9-18	---	---	27-45	1.20-1.30	0.6-2	0.18-0.21	0.0-2.9	1.0-3.0	.28	.28			
	18-60	---	---	35-50	1.20-1.40	0.2-0.6	0.13-0.16	3.0-5.9	0.5-1.0	.28	.37			
66E:														
Freezener	0-9	---	---	20-27	1.20-1.30	0.6-2	0.13-0.16	0.0-2.9	2.0-4.0	.20	.28	5	7	38
	9-18	---	---	27-45	1.20-1.30	0.6-2	0.18-0.21	0.0-2.9	1.0-3.0	.28	.28			
	18-60	---	---	35-50	1.20-1.40	0.2-0.6	0.13-0.16	3.0-5.9	0.5-1.0	.28	.37			
Geppert	0-13	---	---	18-27	1.35-1.50	0.6-2	0.09-0.12	0.0-2.9	2.0-4.0	.10	.37	3	8	0
	13-30	---	---	20-35	1.30-1.40	0.6-2	0.04-0.07	0.0-2.9	0.5-2.0	.10	.37			
	30-40	---	---	---	---	---	---	---	---	---	---			
66G:														

Table J1b. - Physical Properties of the Soils - Continued

Jackson County Area, Oregon, Parts Of Jackson And Klamath Counties

Map Symbol and Soil Name	Depth	Sand	Silt	Clay	Moist Bulk Density	Permeability (Ksat)	Available Water Capacity	Linear Extensi-bility	Organic Matter	Erosion Factors			Wind Erodi-bility Group	Wind Erodi-bility Index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/Hr	In/In	Pct	Pct					
66G:														
Freezener	0-9	---	---	20-27	1.20-1.30	0.6-2	0.13-0.16	0.0-2.9	2.0-4.0	.20	.28	5	7	38
	9-18	---	---	27-45	1.20-1.30	0.6-2	0.18-0.21	0.0-2.9	1.0-3.0	.28	.28			
	18-60	---	---	35-50	1.20-1.40	0.2-0.6	0.13-0.16	3.0-5.9	0.5-1.0	.28	.37			
Geppert	0-13	---	---	18-27	1.35-1.50	0.6-2	0.09-0.12	0.0-2.9	2.0-4.0	.10	.37	3	8	0
	13-30	---	---	20-35	1.30-1.40	0.6-2	0.04-0.07	0.0-2.9	0.5-2.0	.10	.37			
	30-40	---	---	---	---	---	---	---	---	---	---			
67G:														
Freezener	0-9	---	---	20-27	1.20-1.30	0.6-2	0.13-0.16	0.0-2.9	2.0-4.0	.20	.28	5	7	38
	9-18	---	---	27-45	1.20-1.30	0.6-2	0.18-0.21	0.0-2.9	1.0-3.0	.28	.28			
	18-60	---	---	35-50	1.20-1.40	0.2-0.6	0.13-0.16	3.0-5.9	0.5-1.0	.28	.37			
Geppert	0-13	---	---	18-27	1.35-1.50	0.6-2	0.09-0.12	0.0-2.9	2.0-4.0	.10	.37	3	8	0
	13-30	---	---	20-35	1.30-1.40	0.6-2	0.04-0.07	0.0-2.9	0.5-2.0	.10	.37			
	30-40	---	---	---	---	---	---	---	---	---	---			
111G:														
Mcmullin	0-7	---	---	15-25	1.35-1.55	0.6-2	0.10-0.15	0.0-2.9	1.0-3.0	.17	.20	1	7	38
	7-17	---	---	20-35	1.30-1.50	0.6-2	0.10-0.17	0.0-2.9	0.5-1.0	.20	.37			
	17-21	---	---	---	---	---	---	---	---	---	---			
Mcnull	0-6	---	---	20-27	1.35-1.50	0.6-2	0.12-0.16	0.0-2.9	2.0-7.0	.17	.24	3	7	38
	6-32	---	---	35-50	1.25-1.40	0.06-0.2	0.10-0.18	6.0-8.9	0.5-2.0	.17	.28			
	32-42	---	---	---	---	---	---	---	---	---	---			
113E:														
Mcmullin	0-7	---	---	15-25	1.35-1.55	0.6-2	0.10-0.15	0.0-2.9	1.0-3.0	.17	.20	1	7	38
	7-17	---	---	20-35	1.30-1.50	0.6-2	0.10-0.17	0.0-2.9	0.5-1.0	.20	.37			
	17-21	---	---	---	---	---	---	---	---	---	---			
Rock Outcrop	---	---	---	---	---	---	---	---	---	---	---	---	---	---

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Table J1b. - Physical Properties of the Soils - Continued

Jackson County Area, Oregon, Parts Of Jackson And Klamath Counties

Map Symbol and Soil Name	Depth	Sand	Silt	Clay	Moist Bulk Density	Permeability (Ksat)	Available Water Capacity	Linear Extensi-bility	Organic Matter	Erosion Factors			Wind Erodi-bility Group	Wind Erodi-bility Index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/Hr	In/In	Pct	Pct					
113E:														
113G:														
Mcmullin	0-7	---	---	15-25	1.35-1.55	0.6-2	0.10-0.15	0.0-2.9	1.0-3.0	.17	.20	1	7	38
	7-17	---	---	20-35	1.30-1.50	0.6-2	0.10-0.17	0.0-2.9	0.5-1.0	.20	.37			
	17-21	---	---	---	---	---	---	---	---	---	---			
Rock Outcrop	---	---	---	---	---	---	---	---	---	---	---	---	---	---
114E:														
Mcnull	0-6	---	---	20-27	1.35-1.50	0.6-2	0.14-0.18	0.0-2.9	2.0-7.0	.24	.24	3	6	48
	6-32	---	---	35-50	1.25-1.40	0.06-0.2	0.10-0.18	6.0-8.9	0.5-2.0	.17	.28			
	32-42	---	---	---	---	---	---	---	---	---	---			
114G:														
Mcnull	0-6	---	---	20-27	1.35-1.50	0.6-2	0.14-0.18	0.0-2.9	2.0-7.0	.24	.24	3	6	48
	6-32	---	---	35-50	1.25-1.40	0.06-0.2	0.10-0.18	6.0-8.9	0.5-2.0	.17	.28			
	32-42	---	---	---	---	---	---	---	---	---	---			
115E:														
Mcnull	0-6	---	---	20-27	1.35-1.50	0.6-2	0.12-0.16	0.0-2.9	2.0-7.0	.17	.24	3	7	38
	6-32	---	---	35-50	1.25-1.40	0.06-0.2	0.10-0.18	6.0-8.9	0.5-2.0	.17	.28			
	32-42	---	---	---	---	---	---	---	---	---	---			
115G:														
Mcnull	0-6	---	---	20-27	1.35-1.50	0.6-2	0.12-0.16	0.0-2.9	2.0-7.0	.17	.24	3	7	38
	6-32	---	---	35-50	1.25-1.40	0.06-0.2	0.10-0.18	6.0-8.9	0.5-2.0	.17	.28			
	32-42	---	---	---	---	---	---	---	---	---	---			
116E:														
Mcnull	0-6	---	---	20-27	1.35-1.50	0.6-2	0.12-0.16	0.0-2.9	2.0-7.0	.17	.24	3	7	38
	6-32	---	---	35-50	1.25-1.40	0.06-0.2	0.10-0.18	6.0-8.9	0.5-2.0	.17	.28			
	32-42	---	---	---	---	---	---	---	---	---	---			

Table J1b. - Physical Properties of the Soils - Continued

Jackson County Area, Oregon, Parts Of Jackson And Klamath Counties

Map Symbol and Soil Name	Depth	Sand	Silt	Clay	Moist Bulk Density	Permeability (Ksat)	Available Water Capacity	Linear Extensi-bility	Organic Matter	Erosion Factors			Wind Erodi-bility Group	Wind Erodi-bility Index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/Hr	In/In	Pct	Pct					
116E:														
Mcmullin	0-7	---	---	15-25	1.35-1.55	0.6-2	0.10-0.15	0.0-2.9	1.0-3.0	.17	.20	1	7	38
	7-17	---	---	20-35	1.30-1.50	0.6-2	0.10-0.17	0.0-2.9	0.5-1.0	.20	.37			
	17-21	---	---	---	---	---	---	---	---	---	---			
116G:														
Mcnull	0-6	---	---	20-27	1.35-1.50	0.6-2	0.12-0.16	0.0-2.9	2.0-7.0	.17	.24	3	7	38
	6-32	---	---	35-50	1.25-1.40	0.06-0.2	0.10-0.18	6.0-8.9	0.5-2.0	.17	.28			
	32-42	---	---	---	---	---	---	---	---	---	---			
Mcmullin	0-7	---	---	15-25	1.35-1.55	0.6-2	0.10-0.15	0.0-2.9	1.0-3.0	.17	.20	1	7	38
	7-17	---	---	20-35	1.30-1.50	0.6-2	0.10-0.17	0.0-2.9	0.5-1.0	.20	.37			
	17-21	---	---	---	---	---	---	---	---	---	---			
117G:														
Mcnull	0-6	---	---	20-27	1.35-1.50	0.6-2	0.14-0.18	0.0-2.9	2.0-7.0	.24	.24	3	6	48
	6-32	---	---	35-50	1.25-1.40	0.06-0.2	0.10-0.18	6.0-8.9	0.5-2.0	.17	.28			
	32-42	---	---	---	---	---	---	---	---	---	---			
Mcmullin	0-7	---	---	15-25	1.35-1.55	0.6-2	0.10-0.15	0.0-2.9	1.0-3.0	.17	.20	1	7	38
	7-17	---	---	20-35	1.30-1.50	0.6-2	0.10-0.17	0.0-2.9	0.5-1.0	.20	.37			
	17-21	---	---	---	---	---	---	---	---	---	---			
118E:														
Mcnull	0-6	---	---	20-27	1.35-1.50	0.6-2	0.12-0.16	0.0-2.9	2.0-7.0	.17	.24	3	7	38
	6-32	---	---	35-50	1.25-1.40	0.06-0.2	0.10-0.18	6.0-8.9	0.5-2.0	.17	.28			
	32-42	---	---	---	---	---	---	---	---	---	---			
Medco	0-7	---	---	27-35	1.30-1.40	0.2-0.6	0.14-0.18	3.0-5.9	2.0-7.0	.10	.32	3	8	0
	7-12	---	---	30-40	1.30-1.40	0.06-0.2	0.15-0.19	3.0-5.9	0.5-2.0	.10	.32			
	12-30	---	---	50-60	1.20-1.30	0.001-0.06	0.11-0.15	6.0-8.9	0.0-0.5	.15	.32			
	30-40	---	---	---	---	---	---	---	---	---	---			

Table J1b. - Physical Properties of the Soils - Continued

Jackson County Area, Oregon, Parts Of Jackson And Klamath Counties

Map Symbol and Soil Name	Depth	Sand	Silt	Clay	Moist Bulk Density	Permeability (Ksat)	Available Water Capacity	Linear Extensi-bility	Organic Matter	Erosion Factors			Wind Erodi-bility Group	Wind Erodi-bility Index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/Hr	In/In	Pct	Pct					
118E:														
119F:														
Mcnull	0-6	---	---	20-27	1.35-1.50	0.6-2	0.14-0.18	0.0-2.9	2.0-7.0	.24	.24	3	6	48
	6-32	---	---	35-50	1.25-1.40	0.06-0.2	0.10-0.18	6.0-8.9	0.5-2.0	.17	.28			
	32-42	---	---	---	---	---	---	---	---	---	---			
Medco	0-7	---	---	27-35	1.30-1.40	0.2-0.6	0.14-0.18	3.0-5.9	2.0-7.0	.24	.28	3	7	38
	7-13	---	---	30-40	1.30-1.40	0.06-0.2	0.15-0.19	3.0-5.9	0.5-2.0	.24	.28			
	13-35	---	---	50-60	1.20-1.30	0.001-0.06	0.11-0.15	6.0-8.9	0.0-0.5	.15	.32			
	35-45	---	---	---	---	---	---	---	---	---	---			
124F:														
Medco	0-7	---	---	27-35	1.30-1.40	0.2-0.6	0.17-0.20	3.0-5.9	2.0-7.0	.28	.28	3	6	48
	7-13	---	---	30-40	1.30-1.40	0.06-0.2	0.15-0.19	3.0-5.9	0.5-2.0	.24	.28			
	13-35	---	---	50-60	1.20-1.30	0.001-0.06	0.11-0.15	6.0-8.9	0.0-0.5	.15	.32			
	35-45	---	---	---	---	---	---	---	---	---	---			
125F:														
Medco	0-7	---	---	27-35	1.30-1.40	0.2-0.6	0.14-0.18	3.0-5.9	2.0-7.0	.10	.32	3	8	0
	7-12	---	---	30-40	1.30-1.40	0.06-0.2	0.15-0.19	3.0-5.9	0.5-2.0	.10	.32			
	12-30	---	---	50-60	1.20-1.30	0.001-0.06	0.11-0.15	6.0-8.9	0.0-0.5	.15	.32			
	30-40	---	---	---	---	---	---	---	---	---	---			
Mcmullin	0-7	---	---	15-25	1.35-1.55	0.6-2	0.10-0.15	0.0-2.9	1.0-3.0	.17	.20	1	7	38
	7-17	---	---	20-35	1.30-1.50	0.6-2	0.10-0.17	0.0-2.9	0.5-1.0	.20	.37			
	17-21	---	---	---	---	---	---	---	---	---	---			
126F:														
Medco	0-7	---	---	27-35	1.30-1.40	0.2-0.6	0.14-0.18	3.0-5.9	2.0-7.0	.10	.32	3	8	0
	7-12	---	---	30-40	1.30-1.40	0.06-0.2	0.15-0.19	3.0-5.9	0.5-2.0	.10	.32			
	12-30	---	---	50-60	1.20-1.30	0.001-0.06	0.11-0.15	6.0-8.9	0.0-0.5	.15	.32			
	30-40	---	---	---	---	---	---	---	---	---	---			

Table J1b. - Physical Properties of the Soils - Continued

Jackson County Area, Oregon, Parts Of Jackson And Klamath Counties

Map Symbol and Soil Name	Depth	Sand	Silt	Clay	Moist Bulk Density	Permeability (Ksat)	Available Water Capacity	Linear Extensi-bility	Organic Matter	Erosion Factors			Wind Erodi-bility Group	Wind Erodi-bility Index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/Hr	In/In	Pct	Pct					
126F:														
Mcnull	0-6	---	---	20-27	1.35-1.50	0.6-2	0.14-0.18	0.0-2.9	2.0-7.0	.24	.24	3	6	48
	6-32	---	---	35-50	1.25-1.40	0.06-0.2	0.10-0.18	6.0-8.9	0.5-2.0	.17	.28			
	32-42	---	---	---	---	---	---	---	---	---	---			
163A:														
Sevenoaks	0-14	---	---	0-5	1.45-1.75	2-6	0.12-0.16	0.0-2.9	1.0-3.0	.05	.05	5	2	134
	14-60	---	---	0-5	1.50-1.80	6-20	0.06-0.12	0.0-2.9	0.0-0.5	.02	.05			
183E:														
Straight	0-9	---	---	18-27	1.10-1.40	0.6-2	0.03-0.06	0.0-2.9	2.0-4.0	.05	.37	3	8	0
	9-35	---	---	18-30	1.10-1.40	0.6-2	0.06-0.10	0.0-2.9	0.5-1.0	.10	.37			
	35-45	---	---	---	---	---	---	---	---	---	---			
184G:														
Straight	0-9	---	---	18-27	1.10-1.40	0.6-2	0.03-0.06	0.0-2.9	2.0-4.0	.05	.37	3	8	0
	9-35	---	---	18-30	1.10-1.40	0.6-2	0.06-0.10	0.0-2.9	0.5-1.0	.10	.37			
	35-45	---	---	---	---	---	---	---	---	---	---			
Shippa	0-4	---	---	18-27	1.25-1.40	2-6	0.05-0.07	0.0-2.9	2.0-4.0	.05	.24	1	8	0
	4-16	---	---	18-27	1.25-1.40	2-6	0.05-0.09	0.0-2.9	0.0-0.5	.10	.28			
	16-26	---	---	---	---	---	---	---	---	---	---			
185G:														
Straight	0-9	---	---	18-27	1.10-1.40	0.6-2	0.03-0.06	0.0-2.9	2.0-4.0	.05	.37	3	8	0
	9-35	---	---	18-30	1.10-1.40	0.6-2	0.06-0.10	0.0-2.9	0.5-1.0	.10	.37			
	35-45	---	---	---	---	---	---	---	---	---	---			
Shippa	0-4	---	---	18-27	1.25-1.40	2-6	0.05-0.07	0.0-2.9	2.0-4.0	.05	.24	1	8	0
	4-16	---	---	18-27	1.25-1.40	2-6	0.05-0.09	0.0-2.9	0.0-0.5	.10	.28			
	16-26	---	---	---	---	---	---	---	---	---	---			

Table J1b. - Physical Properties of the Soils - Continued

Jackson County Area, Oregon, Parts Of Jackson And Klamath Counties

Map Symbol and Soil Name	Depth	Sand	Silt	Clay	Moist Bulk Density	Permeability (Ksat)	Available Water Capacity	Linear Extensi-bility	Organic Matter	Erosion Factors			Wind Erodi-bility Group	Wind Erodi-bility Index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/Hr	In/In	Pct	Pct					
187A:														
Takilma	0-6	---	---	15-23	1.35-1.50	2-6	0.09-0.14	0.0-2.9	2.0-4.0	.17	.28	5	7	38
	6-15	---	---	18-30	1.30-1.50	2-6	0.06-0.11	0.0-2.9	1.0-3.0	.15	.28			
	15-60	---	---	10-18	1.35-1.60	6-20	0.03-0.05	0.0-2.9	0.2-1.0	.10	.20			

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Mass Wasting

Slope Stability Analysis – Shallow Transnational Slides (Shallow Rapid Slides)

1. Planar and Convex Slopes

The analysis considered average present conditions after fire (Burned Condition) and prior to fire (Unburned Condition). The results of the analysis - factor of safety (FS) and probability of failure (Pf) - are as follows:

Table H-1. Slope Stability of Planar and Convex Slopes

	Unburned Condition (forested)		Burned Condition (denuded)	
Slope (%)	FS	Pf (%)	FS	Pf (%)
65 – 70	1.25	0	1.26	0
70 - 75	1.18	0.1	1.20	0.1
75 – 80	1.13	7	1.08	20
80 – 85	1.08	24	1.03	42
85 – 90	1.03	42	0.99	60

2. Concave and Draw Slopes

The analysis considered average present conditions after fire (Burned Condition) and prior to fire - (Unburned Condition). The results of the analysis - factor of safety (FS) and probability of failure (Pf) - are as follows:

Table H-2. Slope Stability of Concave and Draw Slopes

	Unburned Condition (forested)		Burned Condition (denuded)	
Slope (%)	FS	Pf (%)	FS	Pf (%)
50 – 55	1.29	0	1.18	0.7
55 – 60	1.19	0.2	1.09	10
60 – 65	1.11	5.5	1.01	41
65 – 70	1.04	26	0.95	80
70 – 75	0.98	60	0.90	97

Notes:

- The above analyses consider **average conditions** of the topography and geomorphology. Micro-site conditions (i.e., spring areas, wetlands, areas with internal piping, talus areas, shallow and exposed bedrock areas, etc.) may exist that could differ from these averages.
- Factor of Safety (FS) is the ratio between resisting and driving forces acting on a solid body. The Probability of Failure (Pf) is the relative frequency of factors of safety less than one.
- Slopes over 90 percent may in fact have higher factors of safety (be safer) than indicated above. The depth of soil is less than assumed in the analyses and bedrock outcrops are frequently encountered.
- High ground water conditions (a major storm event) were assumed in the analyses.

- The determination about acceptable risk related to harvesting steep slopes should be made based on consideration of probability of failure (Pf) and consequences of such event occurring. Unacceptable consequences for this project would be initiation of debris torrent, deposition of landslide material onto adjacent private land, and deposition of land slide material into perennial streams. For the substantial, adverse consequences situations, harvesting of trees on slopes with probability of failure (Pf) greater than 20 percent should not be permitted without more detailed, site-specific analysis, i.e., convex and planar slopes over 85 percent, and concave slopes greater than 75 percent. For low consequence slopes, an acceptable probability of failure may be as high as 33 percent, or 1 in 3.

The above analysis indicates the following:

1. Planar and convex slopes can be harvested with minimum risk of triggering landslides.
2. Concave slopes (draws, hollows) have higher, but acceptable risk of slope instabilities.
3. Depending on the level of acceptable risk, areas that exceed these thresholds should not be harvested. In draws, the risk of mass wasting will exceed 10 percent for slopes steeper than 75 percent.
4. When areas are found during field preparations of the units for harvest where obvious instabilities exist and the consequences of failure are high, these micro-sites should be excluded from harvesting.

Debris Torrent Analysis – Mass Movement in Steep Stream Channels

The analysis is based on an analytical method outlined in …. (Ref.) It takes into account the size of streambed material, stream gradient, and quantity of flow within the channels. The analysis considers pre-fire, and short-term and long-term post-fire changes in stream flows. Three states of the channel are contemplated: stable streambed, transport of surface streambed material, and torrent (massive movement of the entire stream bed strata).

Table H-3. Mass Movement in Stream Channels, Pre- and Post-Fire

Channel Gradient	Pre-fire Condition	Post-fire Condition (< 5 years)	Post-fire Condition (> 5 years)
10%	stable	transport	stable
20%	stable	transport	transport
30%	stable/transport	transport/torrent	transport
40%	transport	torrent	transport

Notes:

- The above analyses consider **average conditions** of the topography and geomorphology. Micro-site conditions may exist that could differ from these averages.
- Assumptions made in the above analysis: average substrate material size, D50 is 3”, post-fire channel flow increases are approximately 150 percent.

Slope Stability Analysis – Road Fill Failures

The analysis considered average conditions of a road stream crossing placed on varying stream gradient. The results of the analysis - fill height, fill volume, and factor of safety (FS) - are as follows:

Table H-4. Conditions of Road Stream Crossings

Slope (%)	Fill Height (ft)	Fill Volume (yd^3)	Factor of Safety (FS)
10	5	150	1.67
20	8	300	1.42
30	9	450	1.21
40	11	700	1.12
50	13	1,000	0.99

Notes:

- The above analyses consider **average conditions** of the topography and geomorphology. Micro-site conditions (fill material, condition of drainage structure) may exist that could differ from these averages.
- Factor of Safety (FS) is the ratio between resisting and driving forces acting on a solid body. A FS greater than 1.2 is considered safe for a non-critical road structure. The probability of failure is less than 10 percent. A Factor of Safety less than 1.1 is unacceptable. The probability of failure is high (25 percent or greater).

Appendix I
Hydrology

Table I-1. Temperature Monitoring Locations on BLM Lands and Years Monitored

Site ID	Site Location Description	Highest 7 day temperature for period of record	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
HAWK	Hawk Creek above Sugarpine Creek	74.7					X	X	X	X	X	X
SUGA	Sugarpine Creek above Hawk Creek	72.2					X	X	X	X	X	X
WELK	West Branch Elk Creek above Morine Creek Road	66.6						X				
WEKL	West Branch Elk Creek lower section in T33S, R1E, Sec. 7	70.7										X
ELKW	West Branch Elk Creek below Morine Creek Bridge	70.4					X					
WEKM	West Branch Elk Creek below BLM section line T33S, R1W, Sec. 1	69.4										X
MORI	Morine Creek above Hungry Creek	64.1		X	X	X	X	X	X	X	X	X
HUNG	Hungry Creek @ confluence of Morine Creek	63.2		X	X	X	X	X	X	X	X	X
ELKH	Elkhorn Creek above Hawk Creek	70.6										X
HAKT	Hawk Creek above confluence with Timber Creek in Section 3	66.3										X
MIDE	Middle Creek at Elk Creek	74.7										X
MIDM	Middle Creek at south BLM boundary in Section 29	69.4										X
SUGP	Sugarpine Creek at northern property line Section 11	71.5										X
TMBB	Timber Creek Below the confluence with site BUCK	63										X
TIMT	Timber Creek at West BLM boundary of Section 8	63.6										X
TIMM	Timber Creek at west BLM boundary of Section 9	62.9										X
TIMH	Timber Creek at Hawk Creek	73.9										X

Table I-2. Hydrologic Recovery

Subwatershed	Pre-fire	Post-fire estimates
Sugarpine	82.7	72.7
Sugarpine TSZ	81.6	71.6
West Branch Elk	77.7	67.7
West Branch Elk TSZ	81.8	71.8
Flat Creek	76.1	66.1
Flat Creek TSZ	83.6	73.6
Button	73.5	73.5
Bitter Lick	84.1	84.1

Assume 10% change from mid- and late seral stage to early seral stage based on numbers calculated from BLM-administered lands.

Table I-3. Amount Burned in Transient Snow Zones

	Burn Severity											
	High		Moderate		Low		Very Low/ Unburned		Unburned		Total	
TSZ	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres
Flat Creek	7%	163	33%	727	31%	676	25%	558	4%	83	21%	2207
West Branch Elk	0.5%	11	5%	100	9%	182	11%	221	73%	1,420	18%	1933
Sugarpine Creek	1.5%	94	8%	529	6%	399	14%	889	70%	4,550	61%	6460
Total Transient Snow Zone Acres												**10,600**

Table I-4. Miles of Road Work by Subwatershed

Subwatershed	Full Decommission	Partial Decommission	Improve	Improve/ Gate	Renovate	Renovate/ Gate
Elk Creek/Flat Creek						
Alt. B, C, D, G	9.8	1.4	11.2	1.0	16.6	8.1
Alt. E	10.5	2.0	11.2	1.0	20.0	8.3
Alt. F	7.3	1.3	10.9	1.0	16.2	8.1
West Branch Elk Creek						
Alt. B, C, D, G	15.7	0.2	2.4	0.0	20.1	0.7
Alt. E	18.5	2.4	5.4	1.4	36.5	2.6
Alt. F	4.1	0.2	2.0	0.0	13.3	0.7
Sugarpine Creek						
Alt. B, C, D	7.1	0.9	9.9	0.0	6.6	0.5
Alt. E	7.5	0.9	9.9	0.0	9.9	0.5
Alt. F	6.4	0.9	9.9	0.0	6.4	0.5
Alt. G	6.4	0.9	9.9	0.0	6.4	0.5
Button Creek						
Alt. C, D, G	0.0	0.0	0.0	0.0	0.0	0.0
Alt. B, F	0.0	0.0	0.0	0.0	0.0	0.0
Alt. E	0.4	0.0	0.0	0.0	5.1	1.8
Bitter Lick Creek						
Alt. C, D, G	0.0	0.0	0.0	0.0	0.0	0.0
Alt. B, F	0.0	0.0	0.0	0.0	0.0	0.0
Alt. E	0.0	0.0	0.0	0.0	0.4	0.0

Table I-5. Road Density Pre- and Post-project by Subwatershed

	Pre-project miles/square mile	Post-project miles/square mile
Flat Creek		
Alt. B, C, D, G	5.70	5.2
Alt. E	5.70	5.2
Alt. F	5.70	5.4
West Branch Elk Creek		
Alt. B, C, D, G	4.62	4.1
Alt. E	4.62	3.9
Alt. F	4.62	4.5
Sugarpine Creek		
Alt. B, C, D, G	4.40	4.1
Alt. E	4.40	4.1
Alt. F	4.40	4.1
Button Creek		
Alt. B, C, D, G	5.15	5.15
Alt. E	5.15	5.15
Alt. F	5.15	5.15
Bitter Lick Creek		
Alt. B, C, D, G	3.7	3.7
Alt. E	3.7	3.7
Alt. F	3.7	3.7

Table I-6. Functioning Condition of Streams by Sections within 6th Field Watershed (in miles)

Section	Proper Functioning Condition	Functioning At-Risk with Upward Trend	Functioning At-Risk with No Apparent Trend	Functioning At-Risk with Downward Trend	Non-Functional
Elk-Flat 6th Field Watershed					
32s-1w-12	1.34	1.0	0.11	0.0	0.0
32s-1e-5	0.0	0.49	0.11	0.57	0.0
32s-1e-15	0.49	0.85	1.67	0.19	0.0
32s-1e-33	0.0	0.06	1.27	0.17	0.0
32s-1e-19	2.46	1.84	0.49	0.49	0.11
32s-1e-21	0.0	0.45	0.45	0.0	0.0
32s-1e-17	2.03	2.27	1.34	0.7	0.0
32s-1e-7	1.36	0.45	0.11	0.4	0.0
32s-1e-29	1.23	1.47	1.04	0.45	0.0
32s-1e-30	0.13	0.0	0.57	0.21	0.0
32s-1e-31	0.0	0.0	0.27	0.0	0.19
32s-1e-13	1.23	1.1	0.76	0.23	0.36
Totals	10.27	9.98	8.19	3.41	0.66
Sugarpine 6th Field Watershed					
32s-1e-3	0.83	2.73	0.38	0.0	0.0
32s-1e-4	0.25	0.0	0.0	0.09	0.0
32s-1e-8	1.14	0.8	0.28	0.0	0.0
32s-1e-15	0.25	0.0	0.0	0.09	0.0
32s-1e-5	2.16	1.33	0.3	0.0	0.0
32s-1e-9	0.38	3.09	1.8	0.0	0.0
32s-1e-7	0.68	1.17	0.08	0.11	0.06
Totals	5.69	9.12	2.84	0.29	0.06
West Branch 6th Field Watershed					
33s-1e-7	1.27	0.89	0.85	0.09	0.0
33s-1e-6	0.0	0.27	0.04	0.05	0.0
32s-1w-24	0.83	0.57	0.09	0.0	0.0
33s-1e-5	0.27	0.7	1.25	0.17	0.0
Totals	2.37	2.43	2.23	0.31	0.0

Water Quality Restoration Plan
Rogue Basin
Upper Rogue Sub-basin
Elk Creek

Bureau of Land Management (BLM), Medford District Office

2003

Elk Creek at a Glance	
Hydrologic Unit Code (identification #)	1710030705
Watershed Area/Ownership	Total: 85,418 acres BLM Ownership: 27,044 acres (32 %) USFS Ownership: 23,868 acres (28%) USACE Ownership: 2,618 acres (3%) Non-federal Ownership: 31,888 acres (37%)
Stream Miles Assessed	Total: 28 miles BLM Ownership: 7 miles
303(d) Listed Parameter	Temperature, DO
Key Resources and Uses	Salmonid, aesthetic, recreation
Known Impacts (human)	Timber harvest, roads, agriculture, recreation, utility corridor, cattle grazing, partially completed dam site
Natural Factors	Geology: volcanics and intrusive volcanics Soils: various series and complexes; predominately cobbly or gravelly clay loam – moderate to slow permeability

Statement of Purpose

This water quality restoration plan (WQRP) has been prepared in partial fulfillment of the Bureau of Land Management (BLM) responsibility as a Designated Management Agency (DMA) under the 1972 Federal Clean Water Act. The WQRP further contributes to the Oregon Department of Environmental Quality (ODEQ) development of Total Maximum Daily Loads (TMDL) for the Upper Rogue Sub-Basin and is consistent with provisions of the Memorandum of Agreement (MOA) between the ODEQ and BLM (July 2003).

This plan covers land managed by the BLM and United States Forest Service within the Elk Creek Watershed from the mouth of Elk Creek at the Rogue River to the headwaters of Elk Creek.

The Oregon Department of Environmental Quality has lead responsibility for creating TMDLs and Water Quality Management Plans (WQMP) to address water quality impaired streams for Oregon. This WQRP will be provided to the ODEQ for incorporation into an overall WQMP for the Elk Creek Watershed. ODEQ has a comprehensive public involvement strategy, which includes informational sessions, mailings, and public hearings. The BLM will provide support and participate in this public outreach.

Legal Authorities to be Used

Clean Water Act Section 303(d)

Section 303(d) of the federal Clean Water Act (CWA) as amended, requires states to develop a list of rivers, streams, and lakes that cannot meet water quality standards without application of additional pollution controls beyond the existing requirements on industrial sources and sewage treatment plants. Waters that need this additional help are referred to as “water quality limited” (WQL). Water quality limited waterbodies must be identified by the Environmental Protection Agency (EPA) or by a delegated state agency. In Oregon, this responsibility rests with the ODEQ. The ODEQ updates the list of water quality limited waters every two years. The list is referred to as the 303(d) list. The CWA section 303 further requires that TMDLs be developed for all waters on the 303(d) list. A TMDL defines the amount of pollution that can be present in the waterbody without causing water quality standards to be violated. A WQMP is developed to reduce pollution or pollutants to the load allocation level that will restore the water quality and achieve compliance with water quality standards.

Northwest Forest Plan

Federal land management is guided by the Northwest Forest Plan (NFP) that creates a system of reserves to protect a full range of species and their habitats. Biological objectives of the NFP include assurances that adequate habitat will be retained and will aid in the “recovery” of late-successional forest habitat and associated species and further prevent species from being listed under the Endangered Species Act (ESA). The Aquatic Conservation Strategy (ACS) is an essential component of the NFP, which ensures stream, lake, and riparian protection on Federal lands.

ACS Objectives

The ACS was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within USFS and BLM lands within the range of the northern spotted owl. The strategy seeks to protect salmon and steelhead habitat on lands within the range of Pacific Ocean

anadromous fish.

The ACS strives to maintain and restore ecosystem health at watershed and landscape scales to protect habitat for fish and other riparian-dependent species and resources and restore currently degraded habitat. This approach seeks to prevent further degradation and restore habitat over broad landscapes. Because it is based on natural disturbance processes, it is recognized it may take many decades to accomplish all ACS objectives. Thus, it is reasonable to consider implementation of ACS objectives according to similar timeframes as TMDL implementation.

Elk Creek

Water Quality Restoration Plan 2003

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Elk Creek 5th Field Watershed Analysis

Summary

MORPHOLOGY	
Geographic Province	High Cascades and Western Cascades
Watershed size	85,418 acres
Elevation range	~1450 - ~5800 feet – Mouth of Elk Creek to headwaters
Drainage pattern	asymmetrical dendritic
Total streams	1,010 miles
Drainage density	5.2 miles/mile^2
Sixth-field watersheds	West Branch Elk Creek 19,324 acres Flat Creek 5,890 acres Sugarpine Creek 17,460 acres Bitterlick 19,918 acres Button 12,832 acres Total 85,418 acres
METEOROLOGY	
Annual precipitation	Average annual precipitation ranges from less than 35 inches in the southern portion of the watershed to more than 60 inches in the northern portion.
Precipitation Timing	Mediterranean climate with wet winters and dry, hot summers.
Temperature range	0-110 degrees F seasonally
SURFACE WATER	
Minimum flow	The lowest mean daily flow of record occurred in September of 1994 when the discharge was 0.12 cfs.
Maximum peak flow	Maximum flow on Elk Creek near Trail was 19,200 cfs in Dec. 1964
Reservoirs	No large reservoirs currently within the watershed. Several small pump chances and heliponds; one constructed helipond.
Water quality limited streams	About 30 miles (listed for temperature above 64 degrees) About 11 miles listed for DO <u>Sixth-field water quality limited streams:</u> Elk Creek (5th field) West Branch Elk Creek Bitter Lick Creek
GEOLOGY	
Geologic Type	Western Cascade Volcanics and intrusive volcanic rocks.
Soils	Many different series and complexes. Moderate to slow permeability.

BIOLOGICAL			
Vegetation	Primarily mixed evergreen; conifers and hardwoods. Vegetative communities differ by slope, aspect, elevation and soils.		
Total fish streams	155 miles		
Candidate, threatened, or endangered species	Spotted owl: 18 active sites (LSR is owl core) Fish: Oregon Coast coho salmon steelhead		
Survey and Manage species	Fungi, mollusks, bryophytes, lichens and red tree vole, great grey owl		
Special Status Plants	Numerous species and locations		
HUMAN INFLUENCE			
Counties	Jackson Josephine (small portions along northern boundary)		
Roads	629 miles		
Road density	4.6 mi/ mi^2		
Streams within one tree length of roads	159 miles		
Fish streams within two tree lengths of roads	84.7 miles		
Timber production	GFMA - 0 acres		
Utility corridors	Powerline corridor		
Communities	No communities, scattered rural residential		
PUBLIC LANDS			
BLM Medford lands	27,044 acres (32%)		
	BLM Medford Land Use Allocation	**Acres**	**(Percent)**
	Late-Successional Reserves	27,044	(100)
	Recreation Sites	0	(0)
	River Corridor & Wilderness	0	(0)
	Total	27,044	
Forest Service lands	23,868 acres (28%)		
Army Corps of Engineers lands	2,618 acres (3%)		
State of Oregon lands	225 acres		

Introduction

This document is prepared to uphold the BLM's responsibilities as a DMA under the Clean Water Act. This WQRP provides a framework for describing the management necessary to protect and enhance water quality on federal lands in the Elk Creek Watershed.

This document will detail the extent that federal actions may contribute to changes in water temperature and will outline efforts to protect and enhance or restore water quality on federal lands in this watershed.

Elements of the WQRP have been coordinated with the US Forest Service that manages lands of the Elk Creek Watershed, as well as with other entities with similar land and water management responsibilities in the watershed. The WQRP includes:

1. Condition assessment and problem description
2. Resource Considerations
3. Limiting Factor Analysis
4. Goals and objectives
5. Timeline for implementation, cost, funding
6. Responsible Parties
7. Reasonable Assurance of Implementation
8. Monitoring/Evaluation Plan
9. Public Participation Plan

Element 1: Condition assessment and problem description

Table 1. Land Ownership in the Elk Creek Watershed

Ownership/Land Use	Acres	Percent of Elk Creek Watershed
Medford BLM	27,044	32
Forest Service	23,868	28
Army Corps of Engineers	2,618	3
Other non-federal lands	31,888	37
Total	85,418	100

On July 12, 2002, the Timbered Rock Fire started in the Elk Creek Watershed. This fire grew to approximately 27,000 acres before it was controlled. The fire left areas burned at severities ranging from unburned to high (see FEIS Glossary for burn severity definitions) throughout the watershed creating a mosaic typical of large wildfires. The fire burned through many streams and Riparian Reserves creating many openings along streams. These openings have reduced stream shade, in some cases, to zero percent. This natural event will delay the attainment of water quality standards. Prior to this event, water quality in the watershed varied both spatially and temporally.

Approximately 28 percent of the Elk Creek Watershed is located in the transient snow zone, making it prone to flood events that occur as a result of rain on snow events. Loss of forest vegetation resulting from events such as large fires and logging operations increases the frequency and magnitude of these

events. Much of the upper portion of this watershed consists of steep, confined channels.

Roads contribute to rapid runoff, increased groundwater interception, channel confinement at road crossings, and increased sediment delivery to streams. Most portions of the watershed have road densities greater than three miles of road per square mile, The threshold was established by the National Oceanic and Atmospheric Administration–Fisheries (NOAA-Fish) for properly functioning systems. Within these densely roaded areas, the natural system has been heavily impacted by timber harvest. New high road densities likely altered the timing and duration of localized runoff during storm events. According to current Geographic Information System (GIS) road and stream data, about 39 percent of roads within the Elk Creek are within Riparian Reserves. Of those, approximately 13.5 percent are within the Riparian Reserves of fish-bearing streams.

Elk Creek is designated in the Medford District RMP as a Tier 1 Key Watershed. Tier 1 Key Watersheds were selected for directly contributing to anadromous salmonid and resident fish species conservation (USDI 1995, 22-23).

APPLICABLE WATER QUALITY STANDARDS

Beneficial Uses

Oregon Administration Rules (OAR 340–41–322) list the designated beneficial uses for Rogue River waters, including Elk Creek. The specific beneficial uses occurring in the Elk Creek Watershed are presented in Table 2.

Table 2. Beneficial uses in the Elk Creek Watershed

Beneficial Use		Beneficial Use	
Public Domestic Water Supply	✓	Anadromous Fish Passage	✓
Private Domestic Water Supply	✓	Salmonid Fish Spawning	✓
Industrial Water Supply	✓	Salmonid Fish Rearing	✓
Irrigation	✓	Resident Fish and Aquatic Life	✓
Livestock Watering	✓	Wildlife and Hunting	✓
Boating	✓	Fishing	✓
Aesthetic Quality	✓	Water Contact Recreation	✓
Commercial Navigation and Transportation		Hydro Power	

The Oregon Environmental Quality Commission has adopted numeric and narrative water quality standards to protect these designated *beneficial use*s. In practice, water quality standards have been set at a level to protect the most sensitive beneficial use, with seasonal standards set for uses that do not occur year round. Cold-water aquatic life, such as salmon, and aesthetic quality are the most sensitive *beneficial uses* in the Elk Creek Watershed.

The Clean Water Act of 1972, as amended, provides direction for designated beneficial uses. ODEQ is responsible for developing a list of streams that fail to meet established water quality criteria for one or more beneficial uses. These designated streams are included on the State of Oregon's 303(d) list. Water quality monitoring throughout the Elk Creek Watershed has resulted in 303(d) listings for about 40 miles

of streams that fail to meet established criteria for one or more beneficial uses (see Table 3 and FEIS Map 3-8, 303(d) Listed Streams).

Table 3. Water quality limited streams in the Elk Creek Watershed 2002

Stream	Water Quality Parameter	Miles
Elk Creek	Temperature	13.3
Elk Creek	DO	11.2
West Branch Elk Creek	Temperature	7.4
Bitterlick Creek	Temperature	8.6

* Sugarpine Creek and Hawk Creek are listed as a potential concern for temperature

Streams listed for temperature do not meet the criteria (e.g., the rolling 7 day average of the daily maximum temperature) for anadromous fish rearing (e.g., temperature exceeds 64 degrees). This also applies to the resident fish and other aquatic life, particularly resident cutthroat, which are present in these streams (see FEIS Map 3-9, Fish Distribution).

The Rogue River is a major migration corridor for anadromous fish. Chinook (*Oncorhynchus tshawytscha*) and coho (*Oncorhynchus kisutch*) salmon as well as summer and winter steelhead (*Oncorhynchus mykiss)* are known to spawn in the larger creeks within this watershed during moderate to high flow periods, but are not found in the low order tributaries. Resident cutthroat trout (*Oncorhynchus clarki)* inhabit a large portion of the higher ordered streams in this watershed. Some streams within the southern portion of this watershed may have less than optimal conditions for fish habitat as a result of a partially constructed dam, timber harvest, road building, agriculture, fire suppression, and rural residential development. In most areas in the northern section of the Elk Creek Watershed, it is believed that habitat and spawning conditions are likely near their historic potential because they are mostly undisturbed. High channel gradients, lack of spawning gravel, and relatively infrequent landslides on low order side channels are natural barriers that are potentially limiting fish distribution in this watershed. The partially completed Elk Creek Dam act as a fish barrier and Oregon Department of Fish and Wildlife (ODFW) have been trapping and hauling fish around the site.

Table 4 lists historic and present condition information about elements that may affect temperature in the Elk Creek Watershed.

Table 4. Historic and current conditions of selected elements

Riparian Vegetation	
Historical Condition	• Hardwood dominated early to late seral conditions resulting from regular large scale fire events in this watershed. Though streams flowed through a mosaic of stand ages due to fire activity, riparian areas of lower ordered streams were generally well shaded by the large brush and shrub component along these narrow channels.
Present Condition	• Most riparian areas in this watershed exhibit conditions that are within the range of natural variability due to limited human influence. Some areas along Flat Creek, Middle Creek, and Alco Creek may be outside this range due to changes in peak flows resulting from previous upland timber harvest and the Timbered Rock wildfire.
Forest Health and Productivity	
Historical Condition	• Frequent, large scale fires of varying intensity maintained a mosaic of stand ages and densities.
Present Condition	• Many areas of this watershed still exhibit historical conditions. Portions of harvested areas have densely planted and overstocked (increased competition) stands. Soil compaction has altered small scale hydrologic patterns in areas where tractor harvest was used. •Timbered Rock fire burned approximately 30% of the watershed at various intensities maintaining the mosaic of stand ages and densities.
Roads	
Historic Condition	• Few roads before industrial timber harvesting began in the early 1950s.
Present Condition	• Most roads in this watershed are presently in poor to good condition. There is currently a total of about 629 miles of road with varying distribution. Maintenance on some non-arterial roads has been reduced as a result of decreased funding. These roads are in various stages of deterioration from being overgrown to in some cases having sections that have slid. Many of these deteriorating roads have been inventoried for decommission. • Road density averages 4.6 mi/mi^2
Flow Regime	
Historic Condition	• The range between high and low flows on a yearly basis can be extreme.
Present Condition	• Small changes from historic to current conditions because estimated crown closure density was slightly lower historically than currently. • Timbered Rock fire has increased water available for runoff and therefore changed flow regime by increasing peak flows until vegetation recovers.

Element 2: Resource Considerations

The Elk Creek Watershed is a fifth-field watershed in the Cascade Mountains province, located in southwest Oregon about 20 miles north of Medford, Oregon and just west of Lost Creek Reservoir (see FEIS Map 1-1, Location Map). BLM administers about 27,044 acres (32 percent) of the watershed. Within the Elk Creek Watershed, there are no major communities. There are scattered rural residences throughout this watershed.

Major tributaries of Elk Creek include West Branch Elk Creek, Flat Creek, Middle Creek, Alco Creek, Jones Creek, Sugarpine Creek, Bitterlick Creek, and Button Creek. The watershed has been divided into five sixth-field watersheds (see Table 5 and FEIS Map 3-8, 303(d) Listed Streams) and 54 seventh-field watersheds ranging from about 52 acres to about 7,596 acres. Annual precipitation in the watershed averages about 35-60+ inches, moving south to north. Extended summer drought is common.

Table 5. Sub-watersheds within the Elk Creek Watershed

Sixth-field watershed	Acres	Percent of Elk Creek Watershed	% Burned Hot and Moderate Severity
West Branch Elk Creek	19,324	23%	16%
Flat Creek	15,890	19%	39%
Sugarpine Creek	17,460	20%	16%
Bitterlick Creek	19,918	23%	0%
Button	12,832	15%	0%
Elk Creek 5th Field Total	85,418	100%	12%

The Elk Creek Watershed lies in the Western Cascades geologic province, a volcanic province. The predominant bedrock types are basalt, andesite, tuffs and sedimentary volcanic rock and intrusive volcanic rocks. The volcanic bedrock weathers into small-grained material with a tendency to erode easily.

In this watershed, soils are derived from volcanic rock types. Soils developed from volcanic rock types tend to be shallow and have less soil nutrients and soil development than sedimentary. Organic matter plays an increasing role in the productivity of the volcanic sites.

The most prevalent soils in the watershed are McNull, Medco, Straight, Shippa and Freezener, and Geppert soils and associated complexes. The parent material is andesite, tuff, and breccia bedrock. The soils are predominately cobbly or gravelly clay loam, of moderate to slow permeability. The soil classification, per Unified Soil Classification System, is silty or clayey gravels.

The southern portion of Elk Creek Watershed is like most federal lands in Western Oregon which are intermingled with non-federal lands in a alternating “checkerboard” pattern that is characteristic of much of the Oregon and California (O & C) railroad lands (see Table 1 and FEIS Map 1-1(b). Land Administration). The northern 1/3 of the watershed is typical of US Forest Service lands in that it is in block ownership.

Land Use Allocations

The Medford District Resource Management Plan (RMP) designated land use allocations for federal

lands within the watershed. These allocations provide overall management direction and varying levels of resource protection (see FEIS Map 3-1, Land Use Allocations).

Late-successional reserves (LSRs) are areas designated in the RMP where the major management objective is to protect and enhance the conditions of late-successional and old growth forest ecosystems which serve as habitat for late-successional and old growth forest related species, including the spotted owl and red tree vole. This watershed has a large percentage of land allocated as LSR by USFS and BLM and contained 18 active spotted owl sites before the Timbered Rock Fire.

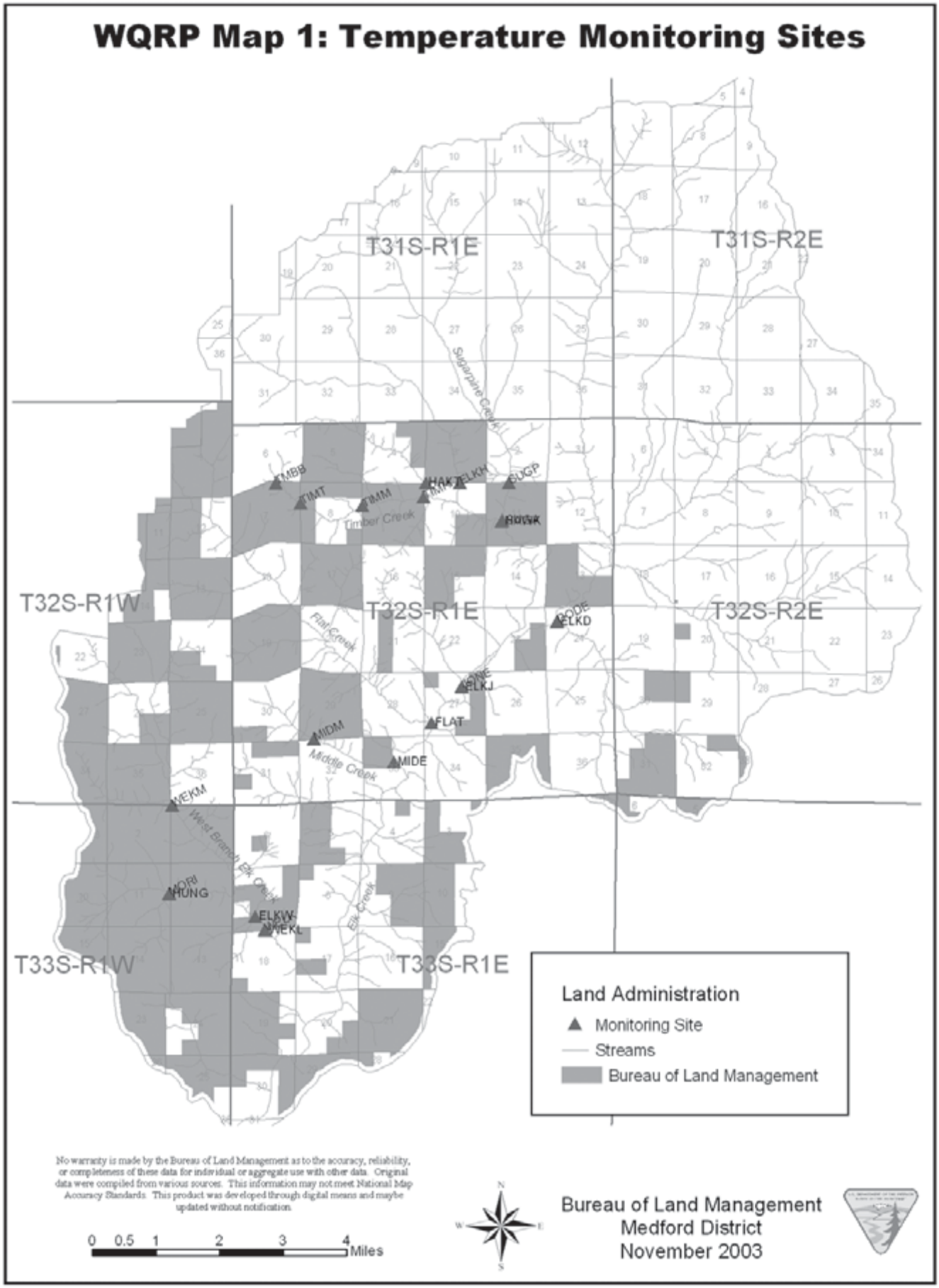
Table 6. Federal Land Use Allocations within the Elk Creek Watershed

Land Use Allocation	Acres	(Percent)
Late-Successional Reserves	50,729	(100)
Total		

Section 303(d)(1) of the Clean Water Act requires that TMDL "be established at a level necessary to implement the applicable water quality standard with seasonal variations." Both stream temperature and flow vary seasonally and from year to year in the Elk Creek Watershed. Water temperatures are cool during the winter months, and exceed the State water quality standard between June and September when stream flows are lowest and solar radiation is the highest. Table 7 lists the site locations where BLM monitoring has occurred (see Map 1). Stream temperatures in Elk Creek exceed water quality standards during some periods between June and September.

Table 7. Temperature Monitoring Locations on BLM Lands and Years Monitored

Site ID	Site Location Description	Highest 7 day temperature for period of record	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
HAWK	Hawk Creek above Sugarpine Creek	74.7					X	X	X	X	X	X
SUGA	Sugarpine Creek above Hawk Creek	72.2					X	X	X	X	X	X
WELK	West Branch Elk Creek above Morine Creek Road	66.6						X				
WEKL	West Branch Elk Creek lower section in T33S, R1E, Sec. 7	70.7										X
ELKW	West Branch Elk Creek below Morine Creek Bridge	70.4					X					
WEKM	West Branch Elk Creek below BLM section line T33S, R1W, Sec. 1	69.4										X
MORI	Morine Creek above Hungry Creek	64.1		X	X	X	X	X	X	X	X	X
HUNG	Hungry Creek @ confluence of Morine Creek	63.2		X	X	X	X	X	X	X	X	X
ELKH	Elkhorn Creek above Hawk Creek	70.6										X
HAKT	Hawk Creek above confluence with Timber Creek in Section 3	66.3										X
MIDE	Middle Creek at Elk Creek	74.7										X
MIDM	Middle Creek at south BLM boundary in Section 29	69.4										X
SUGP	Sugarpine Creek at northern property line Section 11	71.5										X
TMBB	Timber Creek Below the confluence with site BUCK	63										X
TIMT	Timber Creek at West BLM boundary of Section 8	63.6										X
TIMM	Timber Creek at west BLM boundary of Section 9	62.9										X
TIMH	Timber Creek at Hawk Creek	73.9										X


WQRP Map 1: Temperature Monitoring Sites
T31S-R1E
T31S-R2E
T32S-R1W
T32S-R1E
T32S-R2E
T33S-R1W
T33S-R1E
Sugarpine Creek
Timber Creek
Flat Creek
Middle Creek
West Branch Elk Creek
Elk Creek
MBB
TMT
TMM
HAK
ELKM
SUGP
BUCK
ELKD
ELKJ
FLAT
MIDM
MIDE
WEKM
HUNG
ELKW
WEKL
Land Administration
Monitoring Site
Streams
Bureau of Land Management
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and maybe updated without notification.
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Medford District
November 2003

Element 3: Limiting Factor Analysis

Analysis of water quality limited streams in the Elk Creek Watershed

Maximum summer water temperatures in the Elk Creek Watershed have probably always exceeded the current ODEQ standard because the geology and soils of this watershed do not allow for a great degree of water storage. Uplands are steep and soils are relatively shallow. Recharge of streams by ground water is very limited during summer months. In addition, bedrock, which is a major component of the substrate, absorbs heat during the day and radiates it to the stream at night. With RMP allocations and management directions, the acreage harvested in this watershed is relatively small. The BLM believes that cutting in Riparian Reserves alone is not responsible for limiting water quality in this watershed.

Private agriculture operations have removed vegetation along the mainstem of Elk Creek and near the mouths of some tributaries. The partially-constructed dam on Elk Creek has also resulted in loss of riparian vegetation along the mainstem of Elk Creek.

Thus, there are many factors that may contribute to elevated temperature in these streams. In many cases more than one factor is operating on streams and may include:

- Several tributary streams have segments that have no surface flow during summer periods;
- Low summer discharge;
- Riparian cover is absent or reduced due to land practices adjacent to streams; past salvage logging within riparian zones; logging has removed shade over streams;
- Wide streams and stream orientation allow for direct solar heating;
  "Adjacent side slope steepness, vegetation species composition, tree height, vegetation density, tree distance from the stream bank, and stream width all affect effective stream shade. Thus, although riparian vegetation provides a physical barrier between the stream and incoming solar radiation, only a portion of the riparian canopy contributes to effective stream shade" (USDA and USDI 2003, 11).
- Wide, shallow gravel/bedrock channels;
- Relatively low gradient channels result in slower velocities therefore longer water retention time; and
- High percentage of roads in or adjacent to riparian zones.

Stream channel widths on most first through fourth tributary streams are narrow enough for stream-side vegetation to provide adequate shade. Stream side vegetation in this system consists of brush, hardwood and conifer species.

Stream Flow

Flows reflect annual precipitation with higher low flows in wetter years and lower summer flows in drier years. Variation in low flow from year to year is typical for this stream system. Historic data for the gaging station is available at web site address: http://waterdata.usgs.gov/nwis/dv/?site_no=14338000 . Gaging station data is not included in this document due to volume of data on that web site.

Disturbance of the riparian area and stream channel from wildfires and floods can also contribute to increases in summer stream temperatures. These disturbances are considered part of the natural processes, and are expected change agents considered by the ACS (FEMAT 1993). Elk Creek Watershed has a frequent fire history with return intervals ranging from 15 to 100 years depending on

the stand characteristics, weather, and topography. In this watershed, it appears that fires are probably more frequent and intense in the hot, low elevation areas along Elk Creek than in the upper ridges where conditions are cooler and wetter. The eastern portion of this watershed also experiences a greater risk of fire due to the lower amounts of precipitation and higher summer temperatures. Riparian vegetation in areas disturbed by fire and flood will most likely experience fire and floods again in the future. The gain and loss of riparian vegetation by natural processes will fluctuate within the range of natural variability for this watershed and is outside the scope of this assessment. This WQRP focuses on areas where BLM management activities may exacerbate natural disturbance and result in impacts to water quality and quantity.

Factors Affecting Stream Temperature

The Elk Creek Water Quality Restoration Plan addresses stream shade, changes in channel form, and flow as the three management factors that may contribute to water temperature problems.

Temperature Factor 1. - Stream Shade

For the listed parameter, i.e., stream temperature, the beneficial uses affected are: resident fish and aquatic life and salmonid fish spawning and rearing. The state standard for Elk Creek Watershed requires that the seven (7) day moving average of the daily maximum shall not exceed 64 degrees Fahrenheit. A stream is listed as water quality limited when the rolling seven (7) day maximum average exceeds this standard.

Stream temperature is driven by the interaction of many variables. Energy exchange may involve radiation, longwave radiation, evaporative heat transfer, conduction and advection (e.g., Lee 1980, Beschta 1984). While interaction of these variables is complex, certain variables have a greater affect than others (Beschta 1987). For a stream with a given surface area and stream flow, any increase in the amount of heat entering a stream from solar radiation will have a proportional increase in stream temperature. Solar radiation is the singularly most important radiant energy source for the heating of streams during daytime conditions (Beschta 1997).

Without riparian shade trees, most incoming solar energy would be available to heat the stream. Riparian vegetation can effectively reduce the total daily solar heat load. The stream shade assessment determined where the stream shade has been reduced by management activities and calculated the resulting increase in total daily solar heat loading. To determine where shade problems exist and the magnitude of the problem, the stream network of Elk Creek was broken down into sections consisting of the main stem and its tributaries.

Management activities such as harvesting trees in the riparian area can increase the amount of solar radiation entering a stream. Similarly, increased bedload sediment that increases stream surface area can also lead to increases in solar radiation. Finally, water withdrawals during summer months (June-August) may worsen elevated temperature.

The BLM monitored several 303(d) listed streams between 1996 and 2003 (see Table 7) to determine which portions of the streams are water quality limited. Definitive information on where stream temperatures meet the standard on stream reaches has not been analyzed. It will take several years of monitoring to determine the reaches that have temperature limiting problems.

Temperature Factor 2. - Channel Form

Changes in bedload that alter channel morphology result from sediment input that exceeds transport capability of the stream. Sediment deposition can result in channel filling, thereby increasing the width-depth ratio of a stream. An increase in channel width can increase the amount of solar radiation entering a stream. A wide, shallow stream will heat up faster than a narrow, deeper stream with the same discharge. Input of sediments associated with storm events, and management related sources of sedimentation can increase sediment over natural background and contribute to channel widening and subsequent stream temperature increases.

Temperature Factor 3. - Flow

The temperature change produced by a given amount of heat is inversely proportional to the volume of water heated or, in other words, the discharge of the stream. A stream with less flow will heat up faster than a stream with more flow given that all other channel and riparian characteristics are the same. Routing of surface and subsurface waters via interception by road cuts can result in more rapid runoff during storm events and has precluded infiltration and subsequent slower release of stored water in this watershed.

Element 4: Goals and Objectives

Temperature Findings

Assessing the impact of BLM management on temperature will be based on shade and channel form. The BLM's goal is to contribute to reduction of stream temperature through shade recovery on areas of historic timber harvest. These areas are expected to take approximately 30 years after harvest to recover on the smaller tributaries (fourth order and less) on BLM lands. This conclusion is based on current age class of harvest units adjacent to streams on BLM lands taken from operations inventories (see Table 8). Riparian zones on larger tributaries and mainstem Elk Creek may take considerably longer (80 years) to recover.

Table 8. Acres of Riparian Reserve in Elk Creek by age class on Medford BLM lands.

Elk Creek		HUC 6				
Age (years)	**Total**	**West Branch**	**Flat**	**Sugarpine**	**Button**	**Bitterlick***
Non Forest	153	114	13	20	7	n/a
0-10	529	190	266	48	24	
11-20	354	250	62	42		
21-30	226	139	39	48		
31-40	348	114	120	113		
41-50	110	23	37	50		
51-60	210	31	59	88	33	
61-70	108	9	12	29	59	
71-80	196	92	44	24	36	
81-150	1812	1205	300	190	116	
151-200	1820	759	470	574	18	
201+	2037	1306	485	160	85	
Unknown						
Total Acres:	**7,902**	**4,231**	**1,907**	**1,387**	**376**	
% over 30 years	84%	84%	80%	89%	92%	
% over 80 years	72%	77%	66%	67%	58%	
% Burned High/ Moderate	12%	15%	39%	16%	n/a	n/a

*There are no BLM-administered lands in the Bitterlick subwatershed.

An assumption was made that smaller order streams would be shaded by brush, hardwood and conifer species at an earlier age than the larger order streams. Most of the smaller order streams are hillslope constrained and narrow. When the data in Table 8 are compared to the data presented in the allocation for Federally-administered lands (see Appendix A of Appendix 1), there was found to be a strong correlation between modeled existing shade percentage and percentage of seral stages over 30 years of age. The recovery period in the TMDL is based on site potential and time required to reach maturity for conifers and disregards hardwoods and brush species.

Within the Elk Creek Watershed, sub-basins that contain streams listed on the ODEQ 303(d) list, other than the mainstem of Elk Creek, are the West Branch Elk Creek HUC 6 and the Bitterlick Creek HUC 6. Riparian Reserves in this basin have a high percentage of mature trees, and as a result are well shaded. Over 77% of trees within Riparian Reserves in West Branch are over 80 years of age, and approximately 84% are over 30 years. Most of the Bitterlick sub-basin is on USFS land and would maintain Riparian Reserves. Of the three streams on the 303(d) list in this sub-watershed, Bitterlick and West Branch Elk are both fifth order streams, and mainstem Elk Creek is a sixth order stream. West Branch Elk and Bitterlick are in narrow, steep, north-south facing canyons and therefore receive additional shade protection from abundant streamside brush and hardwoods.

OBJECTIVES

All recovery goals and plans are linked to maintaining ecosystem components currently functioning, and improving those sites that show the greatest potential for recovery. This approach will maximize recovery while minimizing expensive, extensive and risky treatments.

The objective of this plan is to eventually meet water quality standards through appropriate management practices. Anthropogenic causes of water quality degradation within this watershed will receive the majority of effort through time for restoration activities. Those standards, when met, will protect the beneficial uses identified for the Rogue Basin under the Oregon Administrative Rules (OAR) 340-41-362.

The recovery of water temperature conditions in the Elk Creek Watershed on federal lands will be dependent upon implementation of the BLM Medford District RMP and the Forest Plan for the Rogue River National Forest. Paramount to recovery is adherence to the Standard and Guidelines of the Northwest Forest Plan that contributes to ACS objectives. These include protection of riparian areas as reserves and may include some silvicultural work to reach vegetative potential as rapidly as possible.

Additional actions are identified in Step 4; Goals for Managed Lands created by ODEQ and presented on page 11 of Appendix 1. Many of these actions are not consistent with BLM's management Standards and Guidelines, or the directives of BLM. Table 9 presents the management techniques that are being implemented on BLM lands to promote the recovery of water quality limited streams, and those intended to protect those streams that are currently properly functioning.

Factors contributing to elevated stream temperatures in the Elk Creek Watershed.

- Several tributary streams have segments that have no surface flow during summer periods; Tributaries with no surface flow are typical due to the low precipitation in the summer and low groundwater storage in the watershed. Management activities can not change this factor.
- Low summer discharge; Low summer discharge is typical due to the low precipitation in the summer and low groundwater storage in the watershed. Management activities can not change this factor.
- Riparian cover is absent or reduced due to land practices adjacent to streams; past salvage logging within riparian zones; logging has removed shade over streams; Riparian Reserves are in place to protect and enhance stream temperatures during future salvage and other logging operations. Thinning or understory thinning is proposed in selected Riparian Reserves to improve tree growth and therefore improve stream shade over time, approximately 30-80 years.

- Wide streams and stream orientation allow for direct solar heating; Stream orientation cannot be changed by management activities. Stream width can be narrowed by adding structure to streams such as boulders and large wood. Boulder weirs were added to Sugarpine and Hawk creeks. Additional BLM projects to add boulder weirs, large wood, and gravel are proposed. Field observations indicate that gravels begin to accumulate after the first few storms, but it is expected to take many years to narrow the stream channels. Over time, large wood falling in streams from Riparian Reserves will also improve channel structure and therefore improve temperature.
- Wide, shallow gravel/bedrock channels; Wide, shallow bedrock channels can be improved by increasing stream structure from the addition of large wood or boulders. Boulder weirs have been added to Sugarpine and Hawk creeks to increase structure, capture gravel, and decrease channel width. Adding large wood, boulder weirs, and gravel to streams are BLM proposed restoration projects to further improve this factor. Gravels would begin to accumulate within the first year while the narrowing of the stream channel would take many years, possibly decades. Large wood will also fall into streams from the Riparian Reserves over time to improve structure.
- Relatively low gradient channels result in slower velocities therefore longer water retention time; Channel gradient cannot be changed from land management activities.
- High percentage of roads in or adjacent to riparian zones. Where possible, the BLM proposes to decommission roads in riparian zones. Approximately 11 miles of road within Riparian Reserves are proposed to be fully decommissioned. Vegetation will recover on decommissioned roads over time and would be at full shade potential after approximately 80 years, with some areas reaching potential sooner.

Table 9. Goals for Federal Lands

Element	Goal	Passive Restoration	Active Restoration
Temperature Shade Component	Achieve coolest water temperatures possible through achievement of shaded riparian reserves.	Allow vegetation to grow naturally in riparian reserves as described in the NFP Aquatic Conservation Strategy	Silvicultural projects designed to promote achievement of site potential hardwood and conifers in a more rapid manner.
Temperature Channel Form Component	Maintain channel configuration of 1st through 4th order streams on BLM lands which are currently hydrologically properly functioning at this point.	Allow natural hydrologic processes to occur within the riparian reserves. Follow standards and guidelines of NFP Aquatic Conservation Strategy	Maintain roads to reduce sediment delivery to streams. Install drainage structures capable of passing 100 year flood events. Decommission roads to minimize potential sediment sources.
Temperature Stream Flow Component	Maintain natural flow conditions. Maintain flow needed for aquatic life.	Minimize consumptive use in management of BLM lands	Work with state Watermaster to identify unauthorized diversions. Reduce road densities by decommissioning roads which are no longer needed for management.

The shade model ran by ODEQ utilized 1996 aerial photos. It is believed that some canopy closure has occurred since 1996 and therefore more shade is already on streams than is indicated in ODEQ's Water Quality Management Plan for the Rogue Basin TMDL. However, the Timbered Rock Fire has reduced shade, in some cases completely, and canopy closure will take decades to fully recover.

Element 5: Timeline for Implementation and Attainment

The goal of the Clean Water Act and associated OARs is that water quality standards shall be met or that all feasible steps will be taken towards achieving the highest quality water attainable. This is a long-term goal in many watersheds, particularly where non-point sources are the main concern.

ODEQ recognizes that TMDLs are values calculated from mathematical models and other analytical techniques designed to simulate and/or predict very complex physical, chemical and biological processes. Models and techniques are simplifications of complex processes, and, as such, are unlikely to produce an exact prediction of how stream surveys will respond to the application of various management measures.

WQMPs are plans designed to reduce pollutant loads to meet TMDLs. ODEQ recognizes that it may take several decades – after full implementation before management practices identified in a WQMP become fully effective in reducing and controlling pollution. In addition, ODEQ recognizes that technology for controlling nonpoint source pollution is, in many cases, in the development stages and

will likely take one or more iterations to develop effective techniques. It is possible that after application of all reasonable best management practices, some TMDLs or their associated surrogates cannot be achieved as originally established.

ODEQ also recognizes that despite the best and most sincere efforts, natural events beyond the control of humans may interfere with or delay attainment of the TMDL and/or its associated surrogates. Such events could be, but are not limited to, floods, fire, insect infestations, and drought.

The WQRP addresses how human activities will be managed. It recognized that full attainment of target load reduction at all locations may not be feasible due to physical, legal or other regulatory constraints. To the extent possible, NFP identifies potential constraints, and provides the ability to mitigate those constraints should the opportunity arise.

Where nonpoint sources are given a zero load allocation, it does not necessarily mean that human-related activities on the land are prohibited or that human activity must be removed from riparian or other areas that might impact water quality. It does mean that anthropogenic activities that might increase heat discharge to the water body must be managed to prevent, to the maximum practicable extent, further warming. Specified management will allow riparian vegetative communities to grow and propagate, and natural fluvial processes such a flood plain formation and bank stabilization to occur.

In employing an adaptive management approach BLM understands ODEQ expectations:

- the progress of the TMDLs and the WQMP on a five year basis
- evaluate the progress towards achieving the TMDLs
- Designated Management Agency (DMA) will monitor and document its progress in implementing the provisions of its WQRP implementation plan
- that DMAs will develop benchmarks for attainment which can be used to measure progress; for management agencies to revise the components of their WQRPs to address deficiencies
- to consult with DMAs on attainment of water quality standards, and revise it as appropriate.

Stream shade recovery will be realized more quickly than habitat recovery with the growth of hardwoods, e.g., alder, maple, ash and cottonwood. Habitat recovery and associated sediment storage/ routing in the channel will only recover to an optimum range of conditions with the recovery of riparian conifers to mature size. This will afford some added shade as these trees grow. Lower summer water temperatures and creation of quality habitat conditions for trout and salmon are anticipated with maturation of riparian forests in these watersheds, addressing road-related problems in the watershed, and reduced timber harvest under the NFP. Harvest related slope failure issues will be addressed through the adaptive management measures within the NFP.

The BLM proposes to accomplish reduction or maintenance of stream temperature through the following during the immediate and near future:

-Renovate and Improve roads (gravel surface, water dip, add drainage structures)
-Make emergency repairs as problems are discovered
-Maintain the BLM road network according to the State BLM Transportation Management Plan
-Utilize passive restoration such as protecting Riparian Zones so that natural recovery is realized
-Utilize active restoration such as understory and overstory thinning in Riparian Reserves.

Specific restoration proposals to accomplish the reduction or maintenance of stream temperature in the

future include:

- Replace 4 culverts for fish passage.
- Install 5 graveled rock weirs per mile.
- Install 20 instream logs per mile.
- Pre-commercial thin 225 acres of stands 10-30 years; less than 8" DBH.
- Thin 134 acres of mid-seral stands 30-80 years old; greater than 8" DBH; no commercial removal.
- Place some thinned trees into stream for fish habitat restoration.
- Plant at 10' x10' spacing with microsite emphasis (planting next to logs, stumps, etc.) in high priority riparian areas (high burn severity areas) and 50-foot strips along high burn severity fish streams.
- Partial decommission of 2.5 miles of road.
- Full decommission of 32 miles of road.
- Close 21 miles of road with a gate or guardrail barricade.
- Approximately 114 miles of seasonal road closures on secondary and non-surfaced roads.

Restoration Prioritization and Funding

Funding for instream restoration will likely be very limited for the BLM. Activity plans include decommissioning of roads, road renovation projects and possible density management projects.

Much of the restoration activity that may occur will likely be funded indirectly through projects (timber sales and silvicultural projects). Other funding sources would be utilized on a project by project basis depending on the criteria set forth in the funding source.

As part of the Clean Water Action Plan, Oregon has begun an interagency effort that identifies high priority watersheds in need of restoration and protection as part of the Unified Watershed Assessment. It is possible that funding associated with the Clean Water Action Plan could be accessed to carry out protection and restoration actions in the Elk Creek Watershed.

Element 6: Responsible Parties

Federal Lands - Participants in this plan for Federal lands include ODEQ, BLM, US Forest Service, and the US Army Corps of Engineers (USACE). The BLM and Forest Service are the major federal land managers in this watershed and are responsible for completion and implementation of the WQRP for federal lands.

Nonfederal Lands - A subsequent WQMP for the remainder of the watershed is expected to be developed by ODEQ and other state agencies responsible for lands within this watershed. That WQMP will address state and locally administered lands, including private forest lands within the Elk Creek Watershed.

The Oregon Department of Forestry (ODF) is for meeting water quality standards on nonfederal forest lands. The Oregon Board of Forestry, in consultation and with the participation and support of ODEQ, has adopted water protection rules in the form of Best Management Practices (BMP) for forest operation. These rules are implemented and enforced by ODF and monitored to assure their effectiveness. ODF and ODEQ will jointly demonstrate how the Oregon Forest Practices Act, forest protection rules (including the rule amendment process) and BMPs are adequate protection for water

quality.

Oregon Water Resources Division (WRD) is a participant within the implementation and monitoring components of this plan. WRD will be doing flow measurements, and will also assist in identifying opportunities for converting consumptive uses to instream rights.

The Oregon Department of Geology and Mineral Industries (DOGAMI) is also a participant with respect to mining impact assessment and permit modifications. DOGAMI covers mining operations that exceed one (1) acre of disturbance or 5000 cubic yards of production within a 12- month period. Operators are required to obtain an operating permit if they are located above the 2-year floodplain of creeks and rivers.

Oregon Department of Agriculture via statute of SB 1010 which established Soil and Water Conservation Districts has jurisdiction over grazing and other farming activities. Active outreach to local farmers and ranchers will continue to occur helping to ensure water quality standards are realized.

Element 7: Reasonable Assurance of Implementation

The following table lists instream and other improvements for restoration of watershed function and water quality. BLM lands in the Elk Creek Watershed have been managed as a LSR and therefore passive restoration was the main approach to restoration in the watershed. An Emergency Stabilization and Rehabilitation Plan (ESRP) was developed as a result of the Timbered Rock fire. Many projects identified in the ESRP have recently been completed.

Table 10. Past Elk Creek Watershed Improvement Projects on BLM Lands

Elk Creek 5th Field			
Project	**Year**	**Amount Treated**	**Fish Present**
Sugarpine and Hawk Creek boulder weirs	1996	~0.25 miles	CO, ST, CT
Removed culvert and log stringer crossing on Middle Creek	2003	2 sites	CO, ST, CT
Removed culverts on tributary to Elk Creek, and on roads 32-1W-25, 32-1E-23, 32-1E-17.04	2003	3 culverts	N/A
Decommissioned roads 32-1E-29.03, 32-1E-17, and 32-1W-26.09	2003	1.2 miles	N/A
Partially decommissioned Road 32-1E-20.4	2003	1.0 mile	N/A

CH = chinook, CO = coho, ST = steelhead, CT = cutthroat N/A= Not Applicable

The following standards and guidelines from the NFP will be used to attain the goals of the Elk Creek Water Quality Restoration Plan:

<u>Stream Temperature – Shade</u>

Aquatic Conservation Strategy: B-9 to B-11, C-30 (denotes section and page # of NFP)
Standard and Guidelines for Key Watersheds: C-7
Riparian Vegetation: B-31
Riparian Reserves: B-12 to B-17 and ROD 9
Watershed Restoration: B-30

Stream Temperature - Channel Form

Aquatic Conservation Strategy: B-9 to B-11, C-30
Standard and Guidelines for Key Watersheds: C-7
Riparian Vegetation: B-31
Riparian Reserves: B-12 to B-17 and ROD 9
Watershed Restoration: B-30
Roads: B-19, B-31 to B-33

BLM upgraded its transportation objectives within each watershed. Part of the plan is to identify roads that need surfacing, pipe replacement or that could be decommissioned.

All the sub-watersheds have high road densities and all are above the two miles per square mile target established by NOAA-Fish. Road densities on BLM lands would be decreased where possible through road decommissioning identified in the Timbered Rock EIS.

The BLM believes restrictions within the NFP have greatly contributed to reducing impacts on the aquatic system. These include, but are not limited to, wide (160' on either side of non fish-bearing streams and 320' on either side of fish-bearing streams) riparian buffers on all streams, including intermittent channels; green-tree retention on harvest units; restrictions on new road construction and requirements for 100 year flood capacity for road crossing structures. Best management practices that were designed for implementation under the NFP also help reduce impacts and in some cases, actually restore conditions to “Properly Functioning,” which is a stable stream capable of withstanding 30-year storm events.

The BLM has followed the standards and guidelines of the NFP ACS and will continue to do so. Until the NFP is revised or replaced, the BLM is responsible for implementation of the NFP.

Temperature - Shade Component

The Butte Falls Resource Area will prescribe riparian stand treatments in stands located adjacent to perennially flowing water (active restoration). This will be done on a small percentage of the watershed and will maintain a no-treatment buffer to maintain water temperatures. Pre-commercial thinning may also occur in conjunction with normal stand maintenance in units having a stream flowing through or adjacent to them. BLM will continue to adhere to the ACS of the NFP by providing riparian reserves along streams.

Temperature - Channel Form Component

Through management activities such as timber sales, Title II county restoration funding and routine maintenance, BLM will endeavor to reduce road generated sediment. Monitoring of actions will take place periodically to ensure desired reduction of sediment is achieved.

Temperature – Flow

Passive management will be stressed as there are no current identified opportunities for flow augmentation within the federal managed lands of this basin.

Element 8: Monitoring/Evaluation Plan

Assessing Potential for Recovery - Properly Functioning Condition Methodology

Recovery of riparian areas, stream channels, and aquatic habitat requires a base condition with adequate vegetation, channel form, and large woody debris to dissipate stream energy associated with high water flows. The BLM/USFS methodology known as Properly Functioning Condition (PFC) assesses the capability of streams to withstand 30-year interval storm events. The BLM/USFS methodology is different than the NOAA-Fish PFC methodology in that it is an assessment of stream channel condition rather than watershed condition. This quick, interdisciplinary method is the first step in determining the feasibility of restoration and recovery (Riparian Area Management TR 1737-15 1998).

BLM will continue to monitor stream temperatures at selected sites in cooperation with ODEQ and the U.S Geological Survey.

Since streams in this watershed are water quality limited as a result of high temperatures, sediment monitoring in the Elk Creek Watershed is limited to effectiveness monitoring of actions associated with road use, construction, decommissioning, or maintenance. In addition to regular effectiveness monitoring, all activities on BLM lands adhere to the Medford RMP BMPs as well as the ACS of the NFP.

Assessing Potential for recovery – ODFW Methodology

Restoration in the Elk Creek Watershed will be both active and passive. Growth of vegetation on floodplains is integral to recovery. The overall goal is to move the attributes considered in this assessment; pool/riffle ratio, pool frequency, large wood, and riparian forest conditions from the present "poor" and "fair" ratings to "good" and "fair," per ODFW benchmarks. These attributes are used to measure if and when the stream is nearing its biological potential for supporting dependent aquatic and riparian species, including anadromous fish. Natural variation will cause changes in stream and floodplain conditions and make allowance for some attributes as being rated "fair". These attributes and benchmarks should be validated with subsequent inventory and monitoring work in the watershed, refining them to suit the range of conditions expected in the watershed as we learn more.

Monitoring will provide information as to whether standards and guidelines are being followed, and if actions prescribed in the WQRP are achieving the desired results. In addition to the monitoring identified in the WQRP, RMP/Forest Plan monitoring occurs annually to assess implementation of standards and guidelines. Information obtained from both sources of monitoring will ascertain whether management actions need to be changed. Continued monitoring would be prioritized upon review of findings.

The monitoring plan itself will not remain static and will be periodically adjusted, as appropriate; to assure the monitoring remains relevant (see Table 11).

Temperature

The BLM, with cooperators, will continue to monitor stream temperatures in portions of the Elk Creek Watershed. We monitor to meet a variety of objectives, so site locations will vary over time. Monitoring activities for BLM will try to determine the source area of temperature increase within reaches of streams that are listed for temperature. Through monitoring, BLM's goal is to determine the upper extent of the problem area and delist the reaches or streams that through time meet the water quality standard

for temperature. Our objectives are to monitor long-term temperature recovery, better understand the natural temperature variability, and to track potential project effects. There are several locations that are monitored annually during the summer months to establish temperature ranges within the basin.

Table 11. Interim Benchmarks and monitoring strategy for Elk Creek

Element	Management Measure	Interim Benchmark	Monitoring Parameter	Monitoring Frequency
Temperature Shade component	Passive treatment of riparian vegetation. Implement standards and guides of NFP. Some PCT and thinning may occur in conjunction with units that have streams flowing through or adjacent to them.	Allow stands to grow toward shade target.	Shade, canopy closure over stream focusing first on hardwood species.	Review of selected reaches every 5 to 10 years using aerial photos, field check condition of riparian vegetation. Within one year complete PFC surveys for selected streams within basin.
Temperature Channel form component	Maintain integrity of streams channels on land under BLM control.	Assess roads and culvert conditions within the watershed within the next 2 years.	Sedimentation resulting from roads by miles of road surfaced or decommissioned.	Review yearly miles of road decommissioned, renovated or maintained.
Temperature Flow component	Road management objectives	Yearly evaluation	Proper drainage and routing	Miles of road decommissioned, out sloped, rocked, number of culverts replaced.

Element 9: Public Participation Plan

This WQRP is a procedural step that focuses on water quality using elements of the NFP. Watershed analyses are a recommended component of the ACS under the NFP and RMP. The Record of Decision (ROD) for the RMP was signed in June of 1995, following extensive public review.

Public involvement was integrated into the development of both the Elk Creek Watershed Analysis, as well as the Timbered Rock EIS (August, 03). Public meetings were held in Butte Falls and Shady Cove during that process. Public involvement for the WQRP will be coordinated by ODEQ in conjunction with the effort addressing state, county and private lands within this watershed.

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Appendix 1- Rogue Basin Riparian Condition Assessment

Rogue Basin Riparian Condition Assessment

BLM and Private Managed Lands

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Hydro Dynamics
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2003

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Legend of Terms, Abbreviations, and Acronyms

General

BLM – Bureau of Land Management
BTU – British Thermal Unit
cfs – cubic feet per second
DEQ – Department of Environmental Quality
FPA – Forest Practices Act
ODFW – Oregon Department of Fish and Wiildlife
OAR – Oregon Administrative Rule
ODF – Oregon Department of Forestry
TMDL – Total Maximum Daily Load
Qa – average annual discharge (stream flow)
USFS – United States Forest Service
USGS – United States Geologic Service
HUC – Hydrologic Unit Code

Assessed Parameters

Definitions/Descriptions of Spreadsheet Parameters

Reach Ident – numeric code: unique identifier for each reach. Reaches are numbered from the headwaters to the mouth.
Stream Name – name of primary stream or location of named tributary confluence.
HUC 5 – Fifth field Hydrologic Unit Code
HUC 6 – Sixth field Hydrologic Unit Code
Stream Name – name of primary stream or location of named tributary confluence.
Percent Tree Overhang – percent vegetative cover on stream surface when the sun is directly overhead of the stream.
Flow Width - Low flow wetted width.
Active Channel Width – As measured from confining bank to confining bank. This is termed Active Channel Width, which in most cases it is equal to bankfull channel width.
Reach Length – linear stream distance for each reach.
Average Tree Height – average height of the shade producing trees or vegetation.
Side Slope – terrain slope under the riparian shade vegetation.
Stream Orientation – Stream direction from north (range +90 to –90).
Active Channel-Riparian Distance – linear distance from the active channel edge to base of riparian vegetation.
Shade Density – percent shade quality with current vegetative conditions.
Banks – Parameters estimated include both banks or east and west banks separately.
Seral Stage – Early = 0 to 39 years, Mid = 40 to 99 years, Late = 100 plus.
Percent Species Composition – Percent composition of hardwoods and conifiers that comprise the total population of the riparian vegetation.
Land Use – F – Forest
M - Mixed
Ag – private agriculture

U– urban

Ownership – Pvt – Private

BLM – Bureau of Land Management

Unstable Stream Banks – Location of unstable stream banks affecting survival of riparian vegetation.

Rosgen Channel Type – stream channel classification based on channel slope, sinuosity, valley type, and stream pattern and form.

Gradient – Slope of the stream channel.

Channel Confinement – As defined by Rosgen: Entrenched (<1.4); Moderately Entrenched ((1.4 – 2.2); Slightly Entrenched (>2.2).

Channel Sinuosity – As defined by Rosgen: Low (<1.2); Moderate (>1.2); High (>1.4).

Stream Order – Stream order is assigned from the top of the drainage down starting with first order (1). At the confluence of two first orders the stream progresses to a second order (2) and so forth. Stream order is based on BLM's GIS stream layer, drainage area and map contours.

ODF Stream Class – 1998 ODF FPA definitions:

F = fish bearing

N = non-fish

D = no fish domestic water source.

Percent Existing Shade - Percent existing stream shade estimated by the SHADOW stream shade model.

Percent Potential Shade – Percent potential stream shade assuming site potential vegetation or that vegetation that produces 80% stream shade, which for small streams may be less than site potential as estimated using the Shadow stream shade model.

Year to Achieve Potential Shade – years to site potential tree height estimated from forest growth models using current tree heights.

Secondary Riparian Width – Distance from the edge of the active channel to the farthest tree that provide shade during low solar radiation hours from 6:00 AM to 10:00 AM and from 2:00 PM to 6:00 PM.

Primary Riparian Width – Distance from the edge of the active channel to the farthest tree that provide shade during high solar radiation hours from 10:00 AM to 2:00 PM.

Data Source – Identifies if aerial photographs or digital orthoquads were used as a data source.

Remarks – Assessment remarks regarding reach conditions.

Step 1

Two methods were used to collect information on the stream reaches. Protocol A supplies the highest resolution information. Protocol B allows for a more rapid assessment but there is some loss in resolution. Comparison of estimated information using this method with field measurements and aerial photographs showed some loss in accuracy in identifying riparian species composition, sediment sources and vegetative height. Table 1 lists the streams and method used and Table 2 the information collected from the photographs and maps.

Table 1. Protocol

	HUC 5	HUC 6	Measured BLM (miles)	Measured Private (miles)	Protocol
Rogue River	1710031008 1710031006 1710031005 1710031004 1710031001 1710030804 1710030802 1710030707		30	91	A
Middle and Lower Rogue					
Foot		171003080206	0	3.7	B
Kane		171003080204	0.6	4.9	B
Sams		171003080203	1.3	6.2	B
Sardine		171003080205	0	3.4	B
Galls		171003080204	0	5.2	B
Bee		171003080401	1.1	0.5	B
Birdseye		171003080207	0.2	3.9	B
Savage		171003080401	0.6	4.5	B
Whiskey		171003100401	2.4	0	B
Louse		171003100203	2.2	10.9	B
Quartz		171003100204	0.7	6.8	B
Jump Off Joe		171003100201 171003100202 171003100204	4.3	20.2	B
Galice		171003100104	1.4	0.4	B
SF Galice		171003100104	0.4	0	B
Mule		171003100407	14	0	B
Dutcher		171003100101	0.08	2.6	B
Hog		171003100102	2.3	2.4	B
Pickett		171003100101	3	2	B
Shan		171003100101	0.6	1.3	B
Taylor		171003100103	0.5	2.1	B
Foster		171003100602	0	0.6	B
Total			**35.68**	**81.6**	
Evans Creek Watershed					
Evans below W.F		171003080306		19.3	
Evans above W.F		171003080301	3.2	12.7	A
WF Evans		171003080306 171003080303	7	8	A
Battle		171003080303	2.5	1.4	B
Cold		171003080303	1.5	2.8	B
Pleasant		171003080305	2.3	11.1	B
Ramsey		171003080304	1.5	1.9	B
Rock		171003080303	3.7	4.1	B
Salt		171003080303	2	4.4	B

Table 1. Protocol

	HUC 5	HUC 6	Measured BLM (miles)	Measured Private (miles)	Protocol
RF Salt		171003080303	2.6	0	B
Total			**26.3**	**65.7**	**B**
Upper Rogue					
Elk		171003070501 171003070502 171003070504 171003070505	0.3	14	A
SF Little Butte		171003070803 171003070805 171003070806	1.6	8.6	A
NF Little Butte		171003070801 171003070802	1	6.6	A
Little Butte		171003070807 171003070808 171003070809 171003070810	0	16.1	A
Jackass		171003070405	2.3	2.4	B
Dog		171003070406	0.8	3.9	B
NF Big Butte		171003070405	6	6.9	B
Big Butte		171003070406 171003070408	2.1	10.1	B
Clark		171003070408	2.1	3.1	B
Twincheria		171003070401	1.7	3	B
Willow		171003070403	0	4.5	B
Hawk		171003070504	0.2	0.7	B
WB Elk		171003070505	5.4	2.6	B
Bitterlick		171003070501	0	1.6	B
Sugarpine		171003070503	0.8	2.4	B
Deer		171003070806	2.2	0.7	A
soda		171003070806	4.9	0.3	A
Lost		171003070806	4.6	4.1	A
Lake		171003070805	1	3.7	A
WF Dead Indian		171003070805	1	1.5	B
Dead Indian		171003070805	0.4	6.4	B
Conde		171003070805	1.2	3.9	B
Antelope		171003070811 171003070812	1.2	21.3	B
Burnt Canyon		171003070811	2	1.8	B
Trail and EF WF		171003070601 171003070602 171003070603	5.3	14.4	B
Total			**48.1**	**144.6**	

Step 2

Protocol A – Stereoscopic aerial photo interpretation and mapping was performed using BLM supplied 1996 color air photos at 1:12,000 scale.

Protocol B – Ortho-photo quads (7.5 min) interpretation and mapping was performed using BLM supplied 1994 quads.

In addition to aerial photos and ortho-quads, reach information was gathered using 7½' USGS quadrangle maps, and ODF stream classification maps

Reach breaks were established using the following criteria: 1) ownership boundaries BLM GIS Map; 2) significant changes in terrain slope; 3) change in aspect class;4) change in riparian vegetation; 5) change in stream width. Each reach was given a unique numeric identification. Reaches were numbered sequentially from headwaters to the mouth.

The riparian assessment consisted of interpretation or measurement of shade parameters, riparian vegetation, and channel conditions. These values were taken either from the color aerial photos, photo ortho-quads or USGS quadrangle map (Table 2). Table 3 lists the miles assessed and listed 303(d) parameter(s).

Modeling results for existing and potential shade values, years to shade recovery and general disturbance types observed are reported in Watershed Summary Table (Appendix A).

Table 2. Photo and map assessed attributes.

Assessment Parameter	Comments
Shade	
Percent Overhang	Photo Estimated
Percent Shade Density	Photo Estimated
Terrain Slope	Map
Aspect	Map
Tree-to-Channel Distance	Photo Estimated
Tree Height	Photo Estimated
Width – Active Channel	Photo measure if possible
Reach Length	Computer program Terrain Navigator
Overhang	Photo Estimated
Vegetation	Photo Estimated
Buffer Width	Fed. = 300' max; Non-fed. = 100' max
Percent of Reach	Non-federal land only
Veg. / Composition mix	Photo Estimated
Channel	
Stream Order (Strahler)	USGS 7½' quadrangles
Stream Slope	Map
Rosgen Channel – Level 1	Photo Estimated
Bank Stability	Photo Estimated
Comments	Photo
Others	
ODF Stream Class	ODF map
Land Use	Photo

Step 3

Table 3. 303(d) Streams assessed and listed 303(d) parameter

Waterbody Name	Stream Segment	Listed Parameter	Miles Assessed
Rogue River	Mouth to RM 132 RM 68.3 to RM110.7 RM 0 to RM94.9	Temperature Fecal Coliform pH	121 0 0
Middle and Lower Rogue			
Foot	Mouth to headwater	Temperature	3.7
Kane	Mouth to headwater	Temperature	5.5
Sams	Mouth to headwater	Temperature	7.5
Sardine	Mouth to headwater	Temperature	3.4
Galls	Mouth to headwater	Temperature	5.2
Bee	Mouth to headwater	Temperature	1.6
Birdeye	Mouth to headwater	Temperature	4.1
Savage	Mouth to headwater	Temperature	5.1
Whiskey	Mouth to headwater	Temperature	2.4
Louse	Mouth to headwater	Temperature	13.1
Quartz	Mouth to headwater	Temperature	7.5
Jump Off Joe	Mouth to headwater	Temperature	24.5
Galice	Mouth to headwater	Temperature	1.8
SF Galice	Mouth to headwater	Temperature	0.4
Mule	Mouth to headwater	Temperature	14
Dutcher	Mouth to headwater	Temperature	2.7
Hog	Mouth to headwater	Temperature	4.7
Pickett	Mouth to headwater	Temperature	5
Shan	Mouth to headwater	Temperature	1.9
Taylor	Mouth to headwater	Temperature	2.6
Foster	Mouth to headwater	Temperature	0.6
Evans Creek Watershed			
Evans	Mouth to headwater	Temperature	35.2
WF Evans	Mouth to headwater	Temperature	15
Battle	Mouth to headwater	Temperature	3.9
Cold	Mouth to headwater	Temperature	4.3
Pleasant	Mouth to headwater	Temperature	13.4
Ramsey	Mouth to headwater	Temperature	3.4
Rock	Mouth to headwater	Temperature	7.8
Salt	Mouth to headwater	Temperature	6.4
RF Salt	Mouth to headwater	Temperature	2.6
Upper Rogue			
Elk	Mouth to headwater	Temperature DO	14.3 0
SF Little Butte	Mouth to headwater	Temperature	10.2
NF Little Butte	Mouth to headwater	Temperature	7.6
Little Butte	Mouth to headwater	Temperature Fecal Coliform DO Sedimentation	16.1 0 0 0

Table 3. 303(d) Streams assessed and listed 303(d) parameter

Waterbody Name	Stream Segment	Listed Parameter	Miles Assessed
Jackass	Mouth to headwater	Temperature	4.7
Dog	Mouth to headwater	Temperature	4.7
NF Big Butte	Mouth to headwater	Temperature	12.9
Big Butte	Mouth to headwater	Temperature DO	12.2 0
Clark	Mouth to headwater	Temperature	5.2
Twincheria	Mouth to headwater	Temperature	2
Willow	Mouth to headwater	Temperature	4.5
Hawk	Mouth to headwater	Temperature	0.9
WB Elk	Mouth to headwater	Temperature	8
Bitterlick	Mouth to headwater	Temperature	1.6
Sugarpine	Mouth to headwater	Temperature	3.2
Deer	Mouth to headwater	Temperature Sediment	2.9 0
Soda	Mouth to headwater	Temperature Sediment	5.2 0
Lost	Mouth to headwater	Temperature Sediment	8.7 0
Lake	Mouth to headwater	Temperature Sediment	4.7 0
WF Dead Indian	Mouth to headwater	Temperature	2.5
Dead Indian	Mouth to headwater	Temperature	6.8
Conde	Mouth to headwater	Temperature	5.1
Antelope	Mouth to headwater	Temperature	22.5
Burnt Canyon	Mouth to headwater	Temperature	3.8
Trail &EF WF	Mouth to headwater	Temperature	19.7

Beneficial Uses in the Rogue Basin

Beneficial Use	Occurring	Beneficial Use	Occurring
Public Domestic Water Supply	√	Anadromous Fish Passage	√
Private Domestic Water Supply	√	Salmonid Fish Spawning	√
Industrial Water Supply	√	Salmonid Fish Rearing	√
Irrigation	√	Resident Fish and Aquatic Life	√
Livestock Watering	√	Wildlife and Hunting	√
Boating	√	Fishing	√
Aesthetic Quality	√	Water Contact Recreation	√
Commercial Navigation & Trans.	√	Hydro Power	√

Water Quality Standards & Criteria of Concern

The water quality standard of concern is temperature and flow modification. The temperature standard for the Rogue Basin tributary streams is defined in OAR 340-41-362, "The rolling seven (7) day average of the daily maximum shall not exceed… 64 deg. F (17.8 deg. C)". The standard for flow modification is defined in OAR 340-41-027, " **The creation of** tastes or odors or toxic or other **conditions that are deleterious to fish or other aquatic life** or affect the potability of drinking water or the palatability of fish or shellfish shall not be allowed. This assessment deals specifically with temperature as affected by riparian vegetation and channel conditions and does not address specific flow related issues.

The beneficial uses affected by high summer stream temperatures and/or low flow regimes on these streams are Resident Fish & Aquatic Life and Salmonid Fish Spawning and Rearing.

Pollution Sources

Disturbances to the stream channel and riparian vegetation include timber harvests, agricultural activity (non-cultivated), local and forest access roads, state or county highways, rural residential, and water withdrawals. Disturbances that are relevant to federally managed lands are timber harvests and roads. Impacts are noted if they occur with in 300 ft of the stream on federal lands or 100 ft on non-federal lands. Although disturbances may be present, their overall impact on riparian shade can be variable.

Step 4. Goals for Managed Lands

Element	Goal	Passive Restoration	Active Restoration
Temperature *Shade Component*	• Achieve coolest water possible through achievement of potential shade values.	• Allow riparian vegetation to grow up to reach target values.	• Bank stabilization where indicated. • Prescriptions that increases growth rate and survival of riparian vegetation. • Prescriptions to ensure long-term vegetation health. • Planting to increase density or to increase tree height.
Temperature *Channel Form Component*	• Maintain or improve Rosgen channel types that exist – types A, B, and C, focusing on width-to-depth ratios. • Decrease bedload contribution to channels during large storm events. • Increase wood-to-sediment ratio during mass failures.	• Allow historic failures to revegetate. • Follow Standards and Guidelines in the NW Forest Plan for Riparian Reserves, and unstable lands. • *Allow natural channel evolution to continue. Time required varies with channel type.*	• Treat roads, esp. sites with diversion potentials. • Minimize future failures through stability review and land reallocation if necessary. • Maintain and improve road surfacing. • Increase pipes to 100-yr flow size and/or provide for overtopping during floods. • *Insure that unstable sites retain large wood to increase wood-to-sediment ratio.*
Temperature *Stream Flow Components:* *- Withdrawals* *- Hydrograph*	• Maintain optimum flows for fish life. • Maintain minimum flows for fish passage.		• Work with state Watermaster to identify and stop illegal diversions. • Eliminate clear-cut logging practices. • Educate water users on effective use and conservation. • Reduce road densities by decommissioning non-essential roads. • *Improve efficiency of withdrawal systems (ditch to pipe).* • *(Purchase/lease floodplain easements.)* • *(Purchase/lease water rights with a focus on high consumptive use and old priority date.)* • *(Enforce existing regulations, including monitoring.)*

Shade Model Assumptions

Shade is based on the earth-sun-terrain/vegetation relationship on August 1 for specified latitudes. The shade model Shadow was used to calculate percent shade.

Existing shade is simply a measure of the amount of shade provided by the existing vegetation to the stream. This may or may not be the "total potential shade" or the most shade possible given the channel characteristics (stream width) and sites ability to grow trees. Existing shade is a measure of the current condition. Site potential shade is the optimum shade that can be expected given the channel and site characteristics.

In theory, it is possible to reach 100% stream shade. However, small amounts of sunlight will penetrate the most densely stocked trees. So in reality, the upper limit of potential stream shade is not 100% but between 95 to 97%. As a stream gets wider, at some point even the tallest of mature trees can't shade the entire channel width.

Site potential shade is the optimum shade expected at a site given its specific characteristic such as stream width and riparian area productivity to grow trees. For this assessment, site potential shade was only projected where human activities have altered riparian vegetation. It does not include areas where poor site conditions restrict vegetation growth, such as serpentine sites, or natural disturbance.

Stream width is an important consideration in determining the height of the trees needed to produce site potential shade. In the assessment, conifers 120 feet in height and with a stand stocking sufficient to produce a shade density of 65% was used for channels greater than 20 feet in width. In the many small tributaries with stream widths less than 20 feet, hardwoods are considered sufficient to produce site potential shade. For these small streams, site potential shade is considered greater than 80%.

Forest growth models were used to project growth rates and heights for the dominant riparian tree species. Growth models are constructed by species and delineated by site index (SI) values that relate to growing conditions. Tree species in Rogue basin and associated SI values are listed in Table 4.

Riparian corridors are assumed to be manage to reach their full site potential condition. Shade densities for site potential conditions were set at 65% for a conifer dominant, mixed old growth stand and 70% for a mature hardwood dominant stand. Stand densities and recovery times (e.g. years to grow to site potential heights) assumes the existing vegetation will continue to grow through seral progressions to a late seral stage. Natural events such as floods or fires may alter the progression rate and achievement of late seral stand conditions.

Passive restoration and the projected time of recovery assume that the vegetation for recovery is present and trees just need time to grow. The aerial photographs used in the assessment are 1996 and the ortho-quads 1994. Recovery time remaining is determined by subtracting the year of the photograph from the current year and then the estimated recovery time. If the data table estimates recovery times of 7 or 9 years, depending on the information source, these sites are most likely recovered.

Active restoration assumes that the time of recovery begins when the identified restoration active occurs. For example, if the active restoration activity identifies planting to increase density with a recovery time of 40 years and that activity doesn't occur for 10 years, then the time of recovery from the present is 50 years.

Table 4. Tree species and forest growth model SI values.

Tree Species	Site Index	Height	Years
Alder	80	100	80
Douglas fir	85	120	80
Ponderosa pine	85	120	75

Appendix A

Weighted stream shade and recovery time

Rogue Assessment										
	BLM				Private				BLM and Private	
	Stream Miles	% Shade		Years to Recovery	Stream Miles	% Shade		Years to Recovery	% Shade	
		Existing	Potential			Existing	Potentia		Existing	Potential
Rogue River	30	2	18		91	8	26		6	20
Middle and Lower Rogue										
Foot	0				3.7	81	82	25		
Kane	0.6	93	93		4.9	86	86		87	87
Sams	1.3	88	88		6.2	84	89	15	85	88
Sardine	0				3.4	76	85	45		
Galls	0				5.2	89	89			
Bee	1.1	99	99		0.5	91	91		96	96
Birdseye	0.2	95	95		3.9	88	90	5	92	93
Savage	0.6	97	97		4.5	75	80	15	88	90
Whiskey	2.4	83	83		0					
Louse	2.2	90	90		10.9	76	80	30	79	84
Quartz	0.7	95	95		6.8	89	89		90	90
Jump Off Joe	4.3	80	82	45	20.2	64	74	80	67	75
Galice	1.4	80	83	70	0.4	63	80	70	76	82
SF Galice	0.4	92	92		0					
Mule	14	90	91	5	0					
Dutcher	0.08	94	94		2.6	79	85	28	80	85
Hog	2.3	91	91		2.4	86	88	8	86	89
Pickett	3	87	88	10	2	74	82	23	81	86
Shan	0.6	92	92		1.3	81	83	10	85	86
Taylor	0.5	88	88		2.1	80	82	35	81	83
Foster	0				0.6	82	82			
Evans Creek										
Evans below W.F					19.3	29	54	80		
Evans above W.F	3.2	88	90	15	12.7	85	88	35	85	88
WF Evans	7	75	81	55	8	63	78	55	69	79
Battle	2.5	94	94		1.4	90	90		93	93
Cold	1.5	84	85	8	2.8	67	81	25	73	83
Pleasant	2.3				11.1					
Ramsey	1.5	84	90	5	1.9	85	91	8	84	90
Rock	3.7	90	90		4.1	84	86	55	87	87
Salt	2	92	92		4.4	82	84	5	85	86
RF Salt	2.6	93	93		0					

Rogue Assessment										
	BLM				Private				BLM and Private.	
	Stream Miles	% Shade		Years to Recovery	Stream Miles	% Shade		Years to Recovery	% Shade	
		Existing	Potential			Existing	Potential		Existing	Potential
Upper Rogue										
Elk	0.3	55	80	50	14	47	74	80	48	74
SF Little Butte	1.6	62	74	40	8.6	33	70	80	38	71
NF Little Butte	1	95	95		6.6	79	83	80	81	85
Little Butte	0				16.1	31	61	80		
Jackass	2.3	89	89		2.4	82	99	12	84	96
Dog	0.8	88	88		3.9	64	80	15	68	82
NF Big Butte	6	72	83	45	6.9	65	82	45	68	83
Big Butte	2.1	52	80	80	10.1	49	80	80	49	80
Clark	2.1	93	93		3.1	84	88	25	88	90
Twincheria	1.7	90	90		3	73	87	35	79	88
Willow	0				4.5	80	84	15		
Hawk	0.2	87	87		0.7	77	80	10	82	85
WB Elk	5.4	85	85		2.6	86	86		86	86
Bitterlick	0				1.6	89	89			
Sugarpine	0.8				2.4	72	76	80		
Deer	2.2	95	95		0.7	99	99		96	96
Soda	4.9	78	89	30	0.3	90	90		79	89
Lost	4.6	92	92		4.1	71	83	40	82	88
Lake	1	97	97		3.7	75	81	25	79	84
WF Dead Indian	1	33	33		1.5	6	6		17	17
Dead Indian	0.4	87	87		6.4	48	53	63	50	55
Conde	1.2	88	88		3.9	20	20		28	28
Antelope	1.2	81	87	55	21.3	71	84	80	75	86
Burnt Canyon	2	95	95		1.8	78	84	10	87	90
Trail	4.1	84	92	65	6.5	52	81	65	65	85
WF Trail	1.2	90	90		7.9	82	83	35	86	88

Appendix J
Fisheries

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

Received
2003
District Office
Medford BLM

Refer to:
2003/00934

August 29, 2003

Tim Reuwsaat
District Manager
Medford BLM District
3040 Biddle Road
Medford, OR 97504

Re: Endangered Species Act Section 7 Informal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Timbered Rock Fire Salvage Project, Medford District Bureau of Land Management, Rogue River Basin, Jackson County, Oregon

Dear Mr. Reuwsaat:

This correspondence is in response to your July 17, 2003, request for consultation under the Endangered Species Act (ESA) for the proposed Timbered Rock Fire Salvage Project in the Elk Creek watershed. Additionally, this letter serves to meet the requirements for consultation under the Magnuson Stevens Fishery Conservation and Management Act (MSA).

ENDANGERED SPECIES ACT

On July 24, 2003, NOAA's National Marine Fisheries Service (NOAA Fisheries) received a complete biological assessment (BA) describing the proposed action and its effects, maps detailing the project location, and a written request for concurrence with a determination that the proposed action is "not likely to adversely affect" (NLAA) Southern Oregon/Northern California (SONC) coho salmon (*Oncorhynchus kisutch*), or their designated critical habitat.

NOAA Fisheries listed SONC coho salmon as threatened under the ESA on May 6, 1997 (62 FR 24588), and designated critical habitat designated on May 5, 1999 (64 FR 54049). Interim protective regulations for SONC coho salmon were issued under section 4(d) of the ESA on July 18, 1997 (62 FR 38479). This consultation is undertaken under section 7(a)(2) of the ESA, and its implementing regulations, 50 CFR Part 402.

The proposed action occurs in four subwatersheds of the Elk Creek watershed: West Branch Elk Creek, Flat Creek, Sugarpine Creek, and Button Creek. Elk Creek is a major tributary to the Upper Rogue River, entering the Rogue River just below Lost Creek Dam. Several streams in the project area are designated critical habitat for SONC coho salmon, including Elk Creek, West

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Branch Elk Creek, Morine Creek, Alco Creek, Flat Creek, Jones Creek, Sugarpine Creek, Hawk Creek, and Bitterlick Creek.

The Medford District Bureau of Land Management (BLM) is proposing to salvage dead timber from 2,334 acres, commercial and pre-commercial thin 2,690 acres, build fuel management zones on 1,300 acres, and perform other restorative management actions on 1,984 acres.

The BLM will be conducting three types of dead tree salvage, research, roadside, and remaining area, on 2,334 acres. There are 328 acres that will be salvaged based on a study design to assess questions about the effects of salvage harvest intensity on wildlife species. There will be light, moderate, heavy, and no treatment units. The light treatment will salvage 35% of the area, the moderate will salvage 70% of the area, and the heavy will salvage 100% of the area, but leave 6 snags per acre. Tractor yarding will occur on 23 acres, cable yarding on 194 acres, and helicopter yarding on 111 acres. There are 14 acres of research treatment within riparian reserves, nine of those acres occur in one unit that is located adjacent to an intermittent stream, 1.5 miles from coho habitat. The roadside salvage consists of taking hazard trees within 200 feet of roads on 955 acres. If any trees identified as a roadside hazard are located within a riparian reserve, they will be felled and left in place. The salvage outside of the research and roadside salvage, called remaining area salvage, will treat 1,051 acres in several scattered units. In Douglas-fir forests, eight snags per acre would be left; in white fir forests, twelve snags per acre would be left; and all down wood and other ecological requirements would be met. No remaining area salvage would occur within riparian reserves. Tractor yarding will occur on 47 acres, cable yarding on 440 acres, and helicopter yarding on 552 acres. To facilitate harvest, 0.8 miles of temporary road will be built and reclaimed.

Commercial and pre-commercial thinning will occur on 2,690 acres. This includes 952 acres of pine habitat restoration where thinning occurs around large pine trees to promote pine growth and regeneration, and reduce competition. None of this will occur within the riparian reserve. Commercial thinning will occur on 479 acres where trees are greater than 8 inches diameter at breast height (dbh), none of which are within riparian reserves. Non-commercial thinning, where all material felled will remain on site, will occur on 1,259 acres. Of this, 347 acres occur within riparian reserves. Coho salmon-bearing streams will receive no-cut buffers of 50 feet; other streams will receive 30-foot buffers.

The other restorative silvicultural treatments include oak woodland and meadow restoration and owl activity center underburns. A total of 1,559 acres of oak woodland and meadows would receive treatment. The treatment consists of thinning small diameter oak and conifers, clearing brush, and applying low intensity fire. There will be a fifty foot no-ignition buffer along streams. The fire is expected to slightly back into the buffer and make a mosaic at fifty feet. The owl activity center underburns cover 425 acres, and consist of using low intensity fires to maintain existing reduced fuel loadings and protect the owl areas from future fires. There will be a 50-foot no-burn buffer on streams in owl activity underburns also.

Fuel management zones will be built on 1,300 acres to assist in future wildfire suppression activities. These zones are built on ridgelines to break up watersheds and provide anchor points for firelines, burnouts, and safety zones for firefighters. Treatment consists of thinning stands, handpiling and burning slash and then underburning to further remove fuels. This work is along ridgelines, there will be no burning near streams.

To facilitate harvest, two roads will have to be built, and several others will need to receive maintenance or renovation. A temporary road 0.8 miles long and a permanent road 0.3 miles long will be built on or near ridgetops, and will not cross any stream channel. Maintenance and renovation will occur on 66.8 miles of road, and will include reshaping road surface, adding rock, installing and replacing drainage culverts, and cleaning catch basins. As many as 14 culverts on intermittent streams will be replaced to allow for a 100-year flow. There will also be 0.9 miles of road decommissioning. Appropriate project design criteria have been compiled using the BLM's Best Management Features and will be applied throughout the project to minimize or eliminate adverse effects to riparian and aquatic habitats resulting from the project. Several of these design criteria are meant to minimize the amount of sediment mobilized from road work. All road work will be completed during the dry season, including hauling. Waterbars, seeding, and mulching will be utilized, and selected roads will be blocked and barricaded before the rainy season.

Based on information provided by the BLM and developed during informal consultation, NOAA Fisheries concurs with the BLM's determination that the proposed project is NLAA for the following reasons: (1) Salvage harvest within riparian reserves is limited to 14 acres of research units, the only harvest adjacent to streams is on an intermittent tributary 1.5 miles from coho salmon critical habitat; (2) no other salvage or thinning will remove material from the riparian reserves; (3) pre-commercial thinning in the riparian reserves include buffers to protect streams; (4) all underburning includes a 50-foot no-burn/ignition buffer on streams; (5) sediment control measures will be used in roadside ditches to minimize sediment delivery to streams; and (6) hauling will be limited to the dry season. Therefore, the proposed project is unlikely to cause incidental take of SONC coho salmon.

The BLM must reinitiate this consultation if: (1) New information reveals that effects of the action may affect listed species in a way not previously considered; (2) the action is modified in a way that causes an effect on listed species that was not previously considered; or (3) a new species is listed or critical habitat is designated that may be affected by the action (50 CFR 402.16).

MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

Federal agencies are required, under §305(b)(2) of the MSA and its implementing regulations (50 CFR 600 Subpart K), to consult with NOAA Fisheries regarding actions that are authorized, funded, or undertaken by that agency that may adversely affect essential fish habitat (EFH). The

MSA (§3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." If an action would adversely affect EFH, NOAA Fisheries is required to provide the Federal action agency with EFH conservation recommendations (MSA §305(b)(4)(A)). This consultation is based, in part, on information provided by the Federal action agency and descriptions of EFH for Pacific salmon contained in Appendix A to Amendment 14 to the *Pacific Coast Salmon Plan* (August 1999) developed by the Pacific Fishery Management Council and approved by the Secretary of Commerce (September 27, 2000).

The proposed action and action area are described above in this concurrence letter and in the BA. Designated EFH for various life stages of coho salmon and chinook salmon (*Oncorhynchus tshawytscha*) occurs within and downstream from the project area.

Because the habitat requirements (*i.e.*, EFH) for the MSA-managed species in the project area are similar to that of the ESA-listed species, and because the conservation measures that the BLM included as part of the proposed action to address ESA concerns are also adequate to avoid, minimize, or otherwise offset potential adverse effects to designated EFH, conservation recommendations pursuant to MSA (§305(b)(4)(A)) are not necessary. Since NOAA Fisheries is not providing conservation recommendations at this time, no 30-day response from the BLM is required (MSA §305(b)(B)).

This concludes consultation under the MSA. If the proposed action is modified in a manner that may adversely affect EFH, the BLM will need to reinitiate EFH consultation with NOAA Fisheries in accordance with NOAA Fisheries implementing regulations for EFH at 50 CFR 600.920(k).

Please direct questions regarding this letter to Chuck Wheeler of my staff in the Oregon Habitat Branch at 541.957.3379.

Sincerely,

Marc Liverman/for

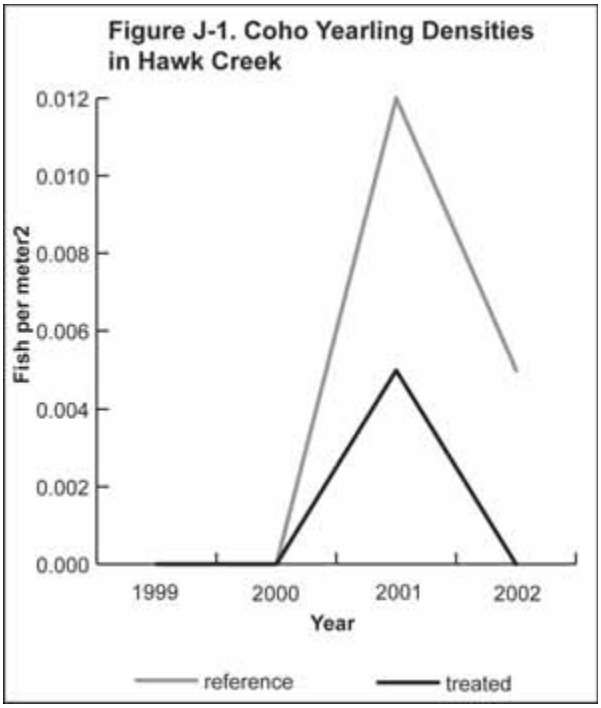
D. Robert Lohn
Regional Administrator

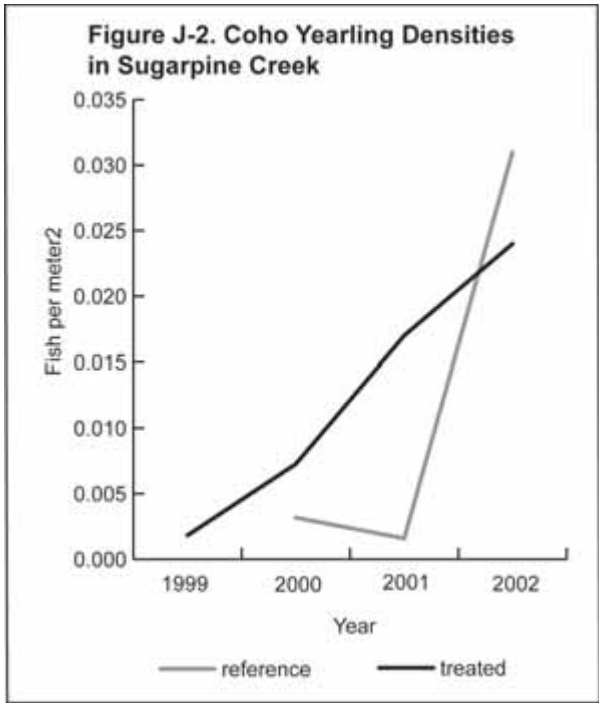
cc: Bill Hudson, Coos Bay BLM District
Dale Johnson, Medford BLM District
Dan Delaney, Rogue-Siskiyou National Forest
Craig Tuss, Fish and Wildlife Service

Table J-1. Returns of Wild Adult Anadromous Salmonids to the Elk Creek Trap

Year	Chinook Salmon	Coho Salmon	Steelhead
1992-93	29	40	112
1993-94	2	76	105
1994-95	8	232	201
1995-96	57	349	283
1996-97	34	319	493
1997-98	22	982	224
1998-99	12	404	351
1999-00	9	288	265
2000-01	26	698	572
2001-02	9	1378	715

NOTE: 2001-02 totals are preliminary





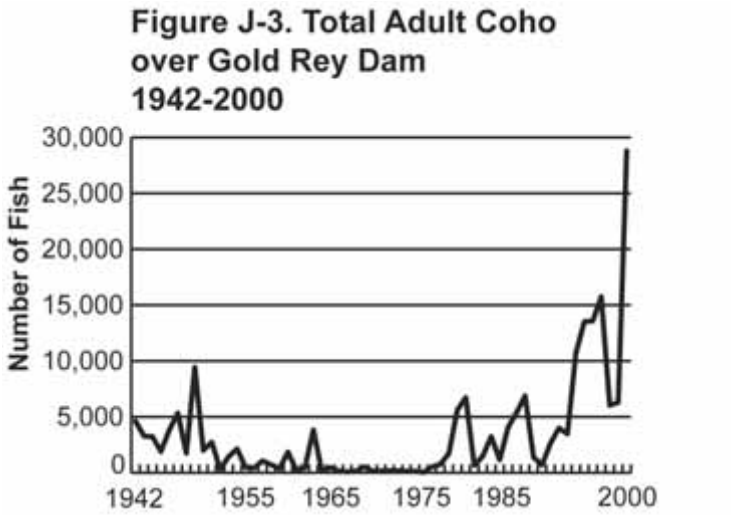


Figure J-3. Total Adult Coho
over Gold Rey Dam
1942-2000
Number of Fish
30,000
25,000
20,000
15,000
10,000
5,000
0
1942
1955
1965
1975
1985
2000

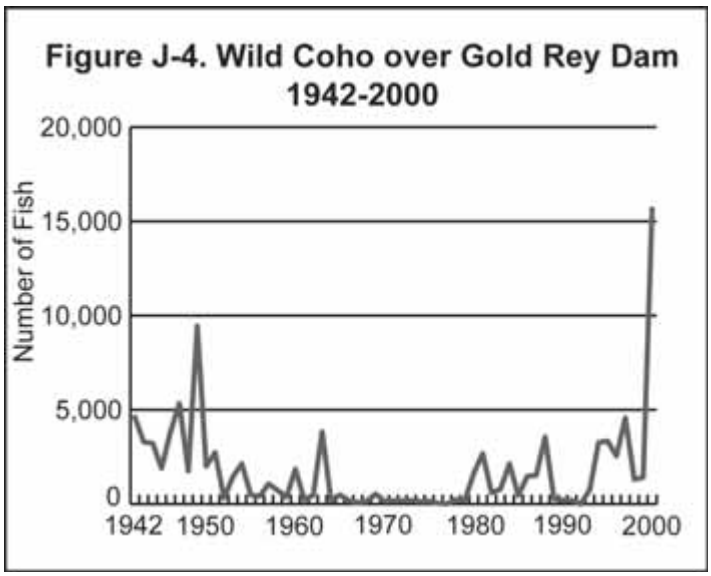


Figure J-4. Wild Coho over Gold Rey Dam
1942-2000
Number of Fish
20,000
15,000
10,000
5,000
0
1942
1950
1960
1970
1980
1990
2000

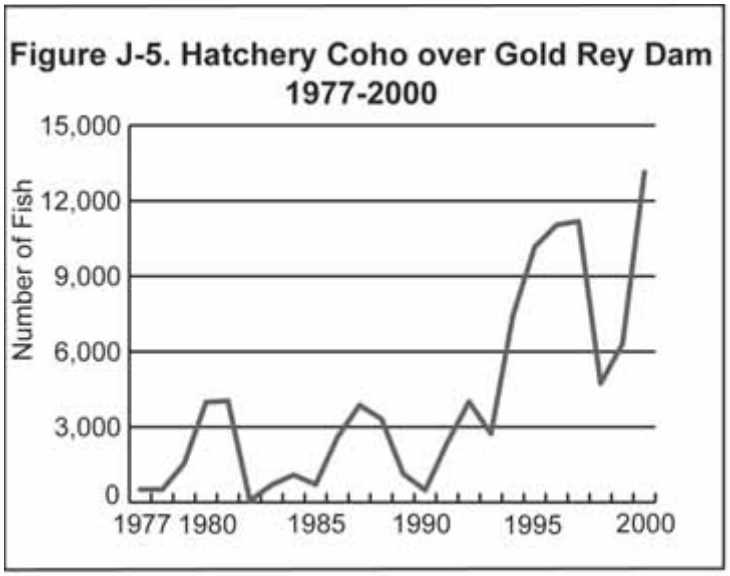


Figure J-5. Hatchery Coho over Gold Rey Dam
1977-2000
Number of Fish
15,000
12,000
9,000
6,000
3,000
0
1977
1980
1985
1990
1995
2000

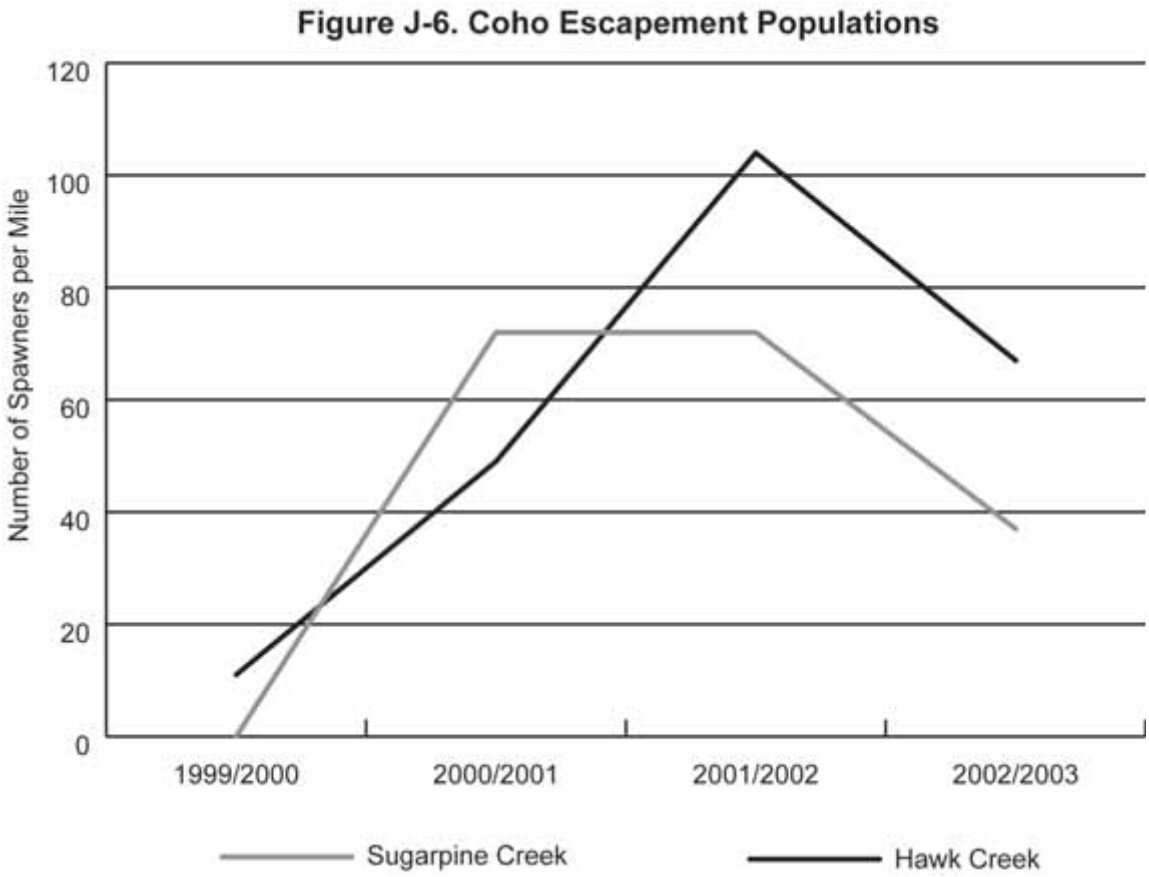


Figure J-6. Coho Escapement Populations
Number of Spawners per Mile
120
100
80
60
40
20
0
1999/2000
2000/2001
2001/2002
2002/2003
Sugarpine Creek
Hawk Creek

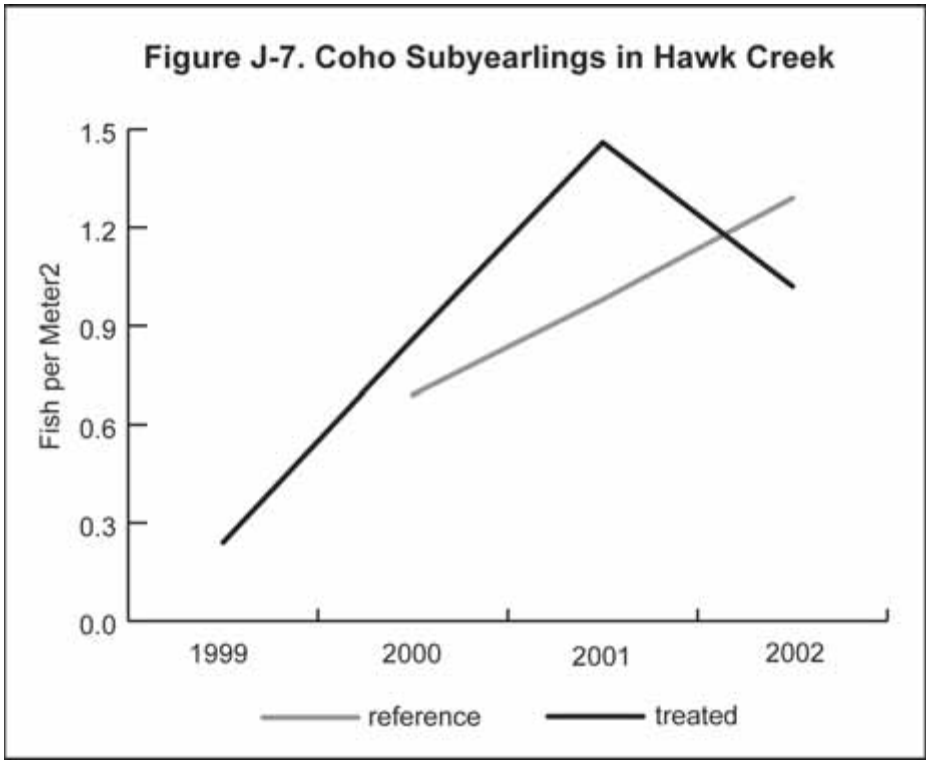


Figure J-7. Coho Subyearlings in Hawk Creek
Fish per Meter2
1.5
1.2
0.9
0.6
0.3
0.0
1999
2000
2001
2002
reference
treated

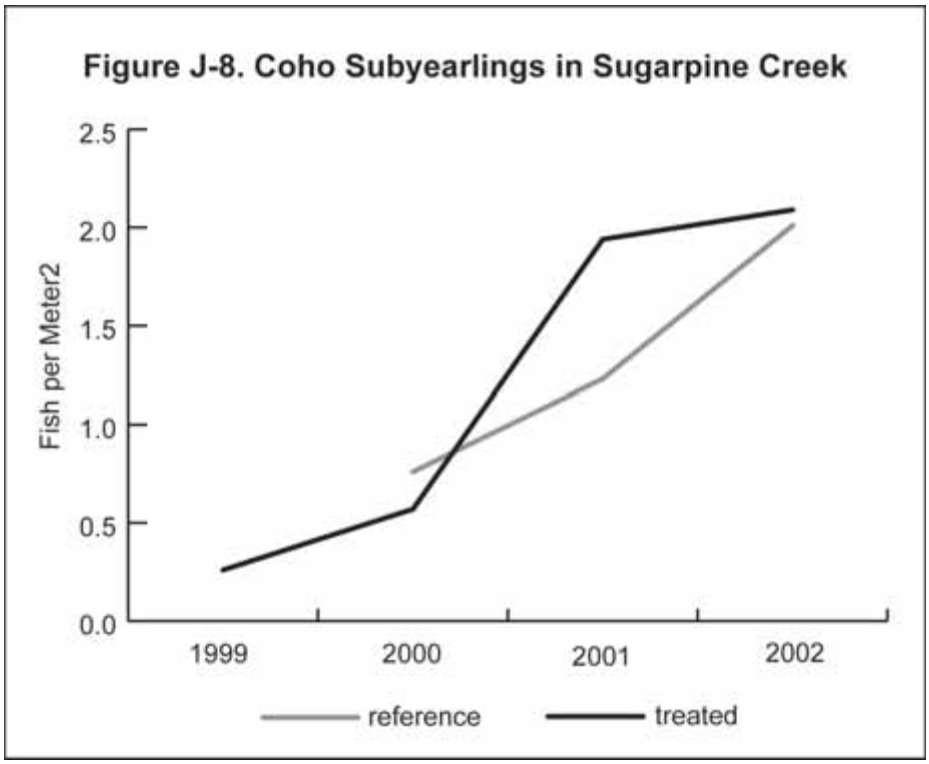


Figure J-8. Coho Subyearlings in Sugarpine Creek
Fish per Meter2
2.5
2.0
1.5
1.0
0.5
0.0
1999
2000
2001
2002
reference
treated

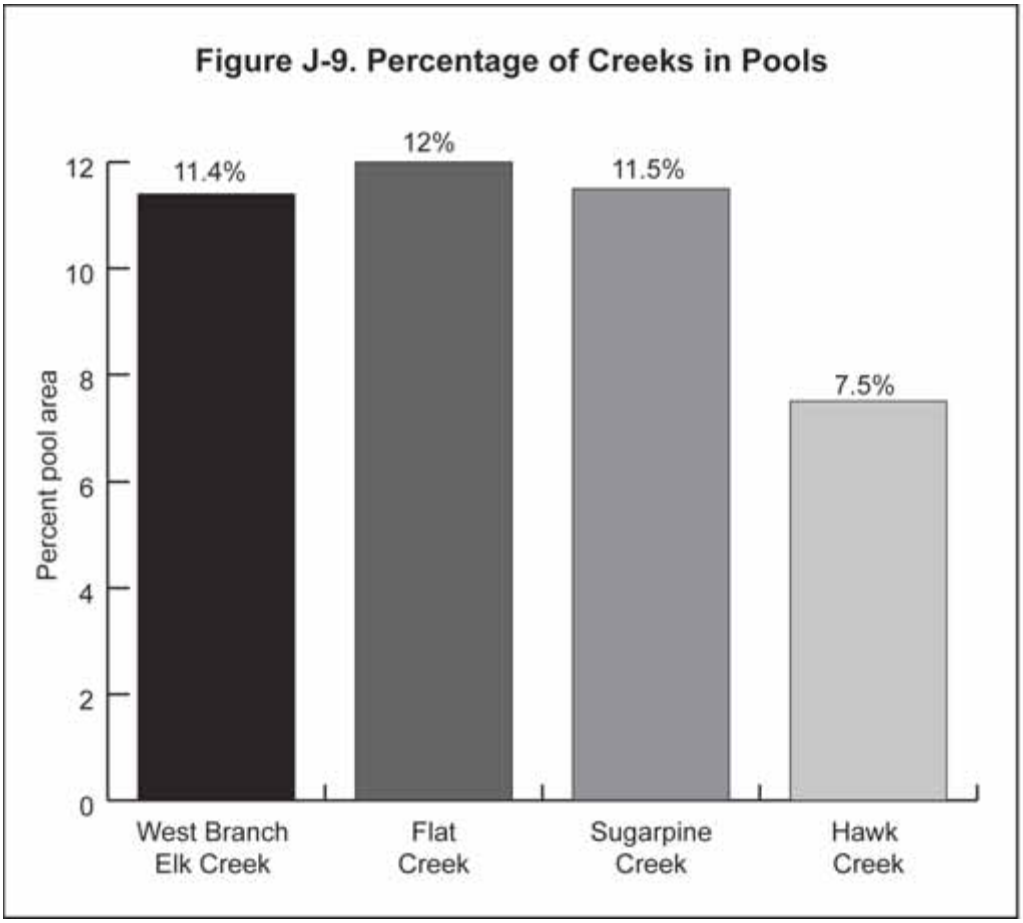


Figure J-9. Percentage of Creeks in Pools
Percent pool area
12
10
8
6
4
2
0
11.4%
12%
11.5%
7.5%
West Branch Elk Creek
Flat Creek
Sugarpine Creek
Hawk Creek

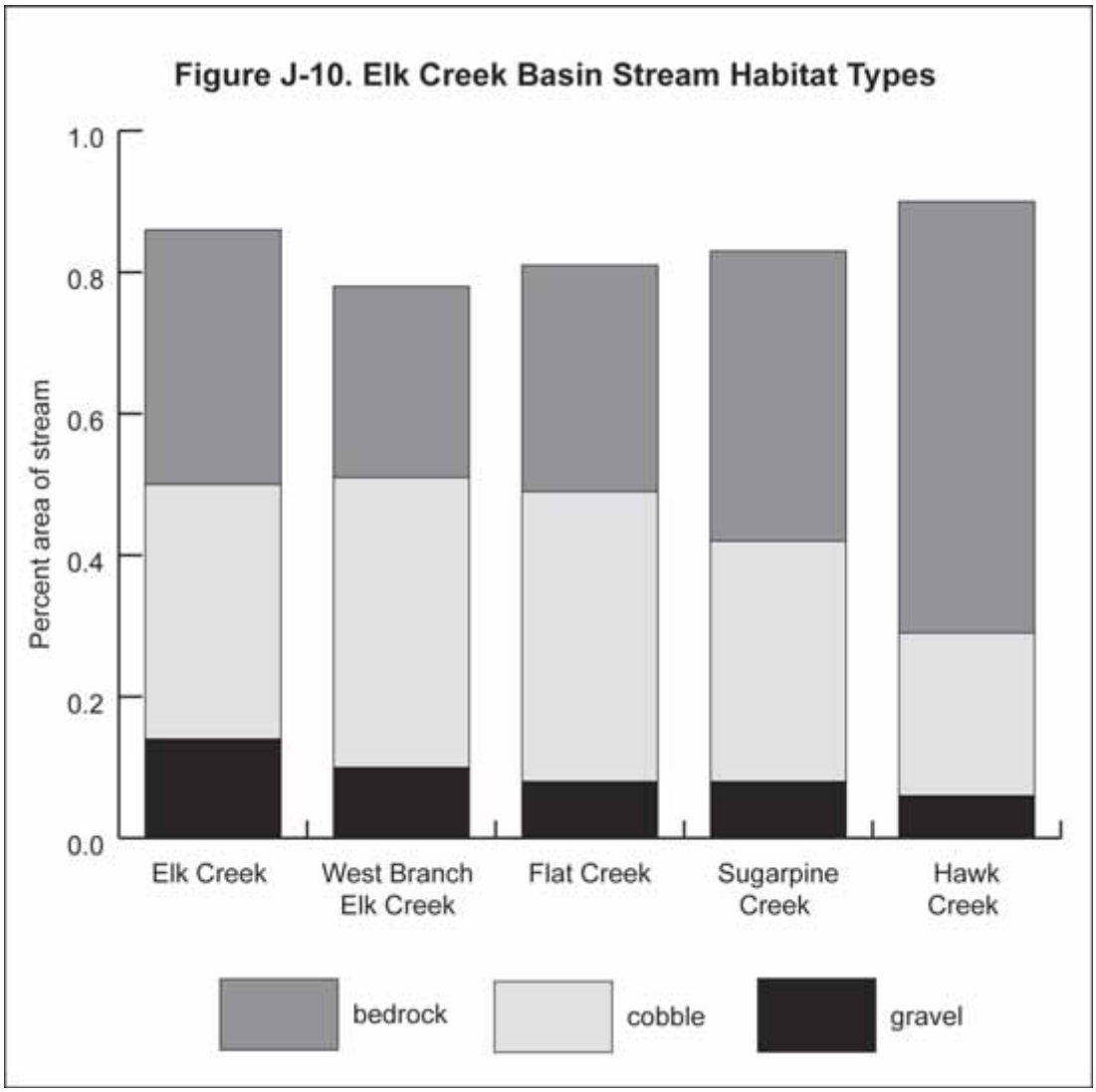


Figure J-10. Elk Creek Basin Stream Habitat Types
1.0
0.8
0.6
0.4
0.2
0.0
Percent area of stream
Elk Creek
West Branch Elk Creek
Flat Creek
Sugarpine Creek
Hawk Creek
bedrock
cobble
gravel

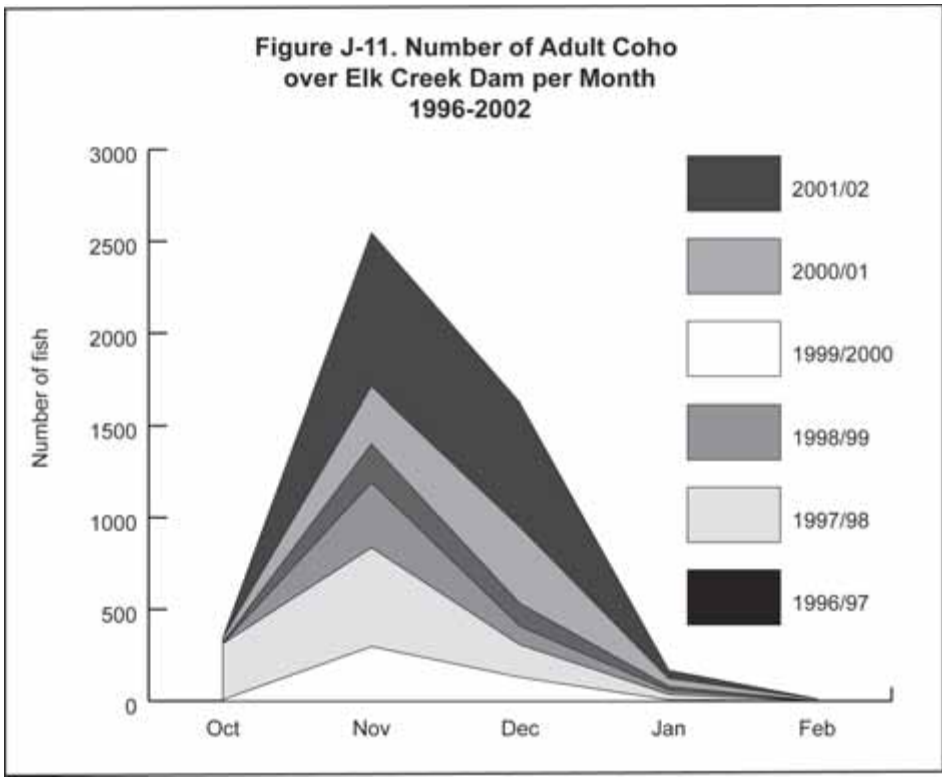


Figure J-11. Number of Adult Coho
over Elk Creek Dam per Month
1996-2002
Number of fish
3000
2500
2000
1500
1000
500
0
Oct
Nov
Dec
Jan
Feb
2001/02
2000/01
1999/2000
1998/99
1997/98
1996/97

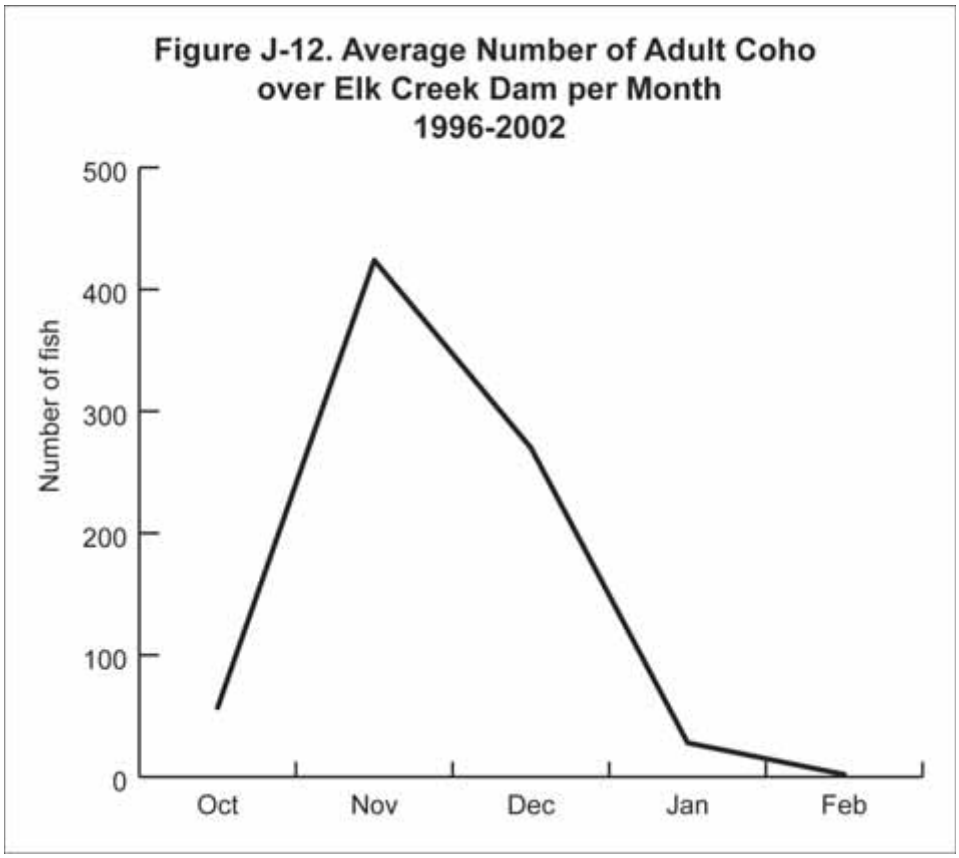


Figure J-12. Average Number of Adult Coho
over Elk Creek Dam per Month
1996-2002
Number of fish
500
400
300
200
100
0
Oct
Nov
Dec
Jan
Feb

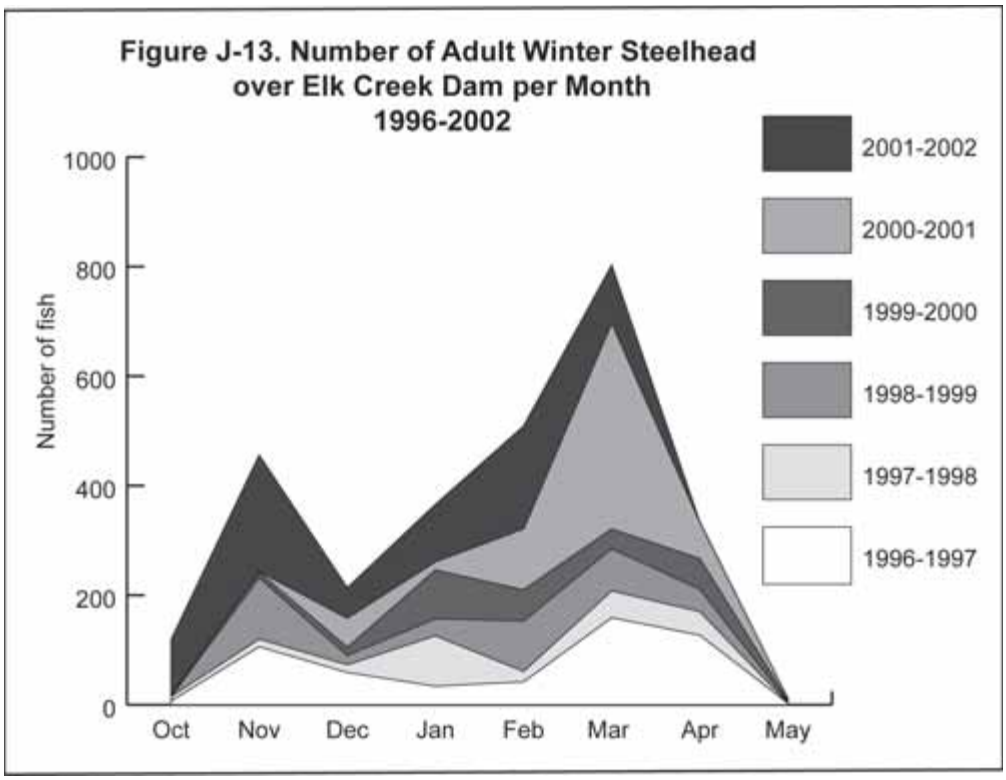


Figure J-13. Number of Adult Winter Steelhead
over Elk Creek Dam per Month
1996-2002
Number of fish
1000
800
600
400
200
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
2001-2002
2000-2001
1999-2000
1998-1999
1997-1998
1996-1997

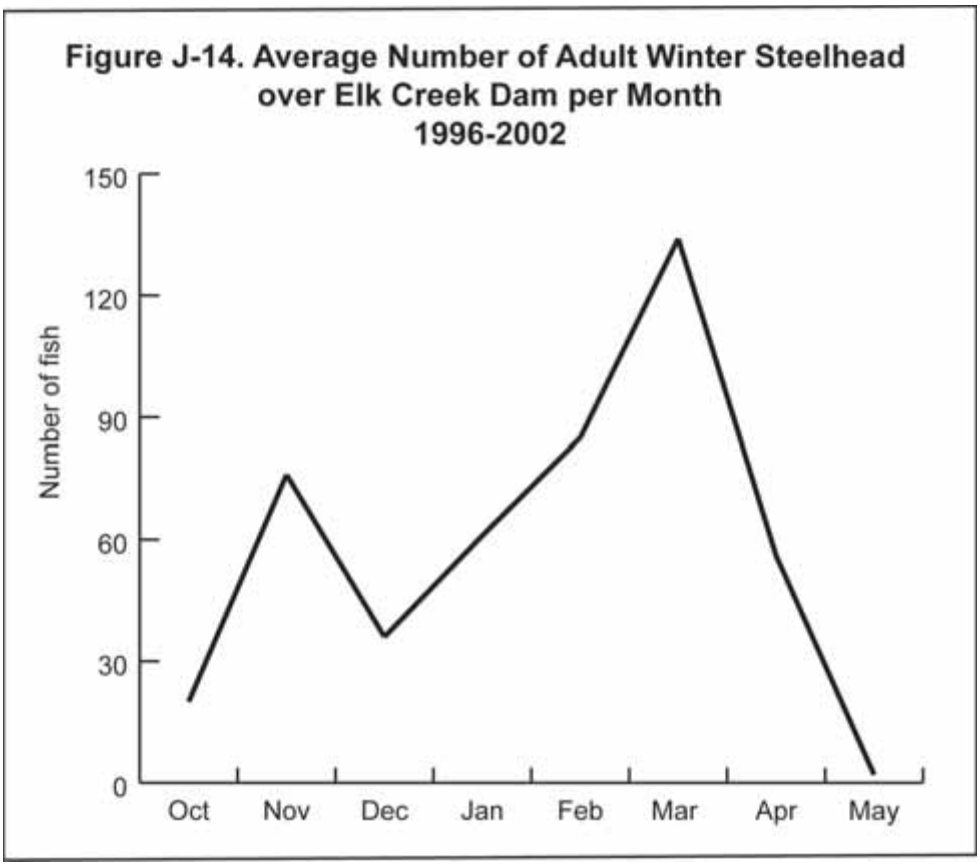


Figure J-14. Average Number of Adult Winter Steelhead
over Elk Creek Dam per Month
1996-2002
Number of fish
150
120
90
60
30
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May

Appendix K
Vegetation

Table K –1. Sample Description of Potential Treatment Area by Restoration Activity

	Existing Conditions	Stand in 50 years No Action- Alternatives A, F	Stand in 50 years Alternatives B, C, D, E, G
Late-Successional Forest Habitat Restoration			
10-30 year age class	• Generally 4-8" DBH. • Stands dominated by Douglas-fir 50-90%, up to 1,000 trees per acre (tpa), with incense cedar, madrone, chinquapin, and sugar pine from 10-30%. On southerly aspects, ponderosa pine up to 10% and on northerly aspects white fir and big leaf maple up to 20%. • Canopy closures high, 80-100% with areas void of trees occupied by shrubs.	• 10-14" DBH. • Stands dominated by Douglas-fir 60-90%, up to 400 tpa. Incense cedar, sugar pine, madrone, chinquapin from 10-30%. Southerly aspects with ponderosa pine up to 5% with white fir and big leaf maple on northerly aspects up to 20%. • Canopy closures 80-100% with fewer openings. • Increase in small diameter snags and coarse woody debris up to 8" DBH.	• 12-16" DBH. • Stands dominated by Douglas-fir 50-90%, up to 200 tpa. Incense cedar, sugar pine, madrone, chinquapin from 10-30%. Southerly aspects with ponderosa pine up to 10% with white fir and big leaf maple on northerly aspects up to 20%. • Canopy closures 80-100%. • Slight increase in small diameter snags and coarse woody debris up to 10" DBH.
30-80 year old stands	• 8-18" DBH. • Stands dominated by Douglas-fir 50-90%, up to 300 tpa, with incense cedar, madrone, chinquapin, and sugar pine from 10-30%. On southerly aspects, ponderosa pine up to 10% and on northerly aspects white fire up to 20% with occasional big leaf maple. • Canopy closures are high 80-100%. Stand in stem exclusion stage, with scattered mortality of suppressed trees.	• 13-23" DBH. • Stands dominated by Douglas-fir 70-90%, up to 200 tpa. Incense cedar, sugar pine, madrone, chinquapin from 10-20%. On southerly aspects, ponderosa pine up to 5% and on northerly aspects white fir up to 20% with big leaf maple. • Canopy closures 90-100% with fewer openings. • Increase in small diameter snags and coarse woody debris up to 14" DBH	• 16-26" DBH. • Stands dominated by Douglas-fir 60-80%, up to 100 tpa. Incense cedar, sugar pine, madrone, chinquapin from 10-30%. Southerly aspects, ponderosa pine up to 5% and on northerly aspects, white fir up to 20% with big leaf maple. • Canopy closures 80-100%. • Increase in snags and coarse woody debris up to 16" DBH.
Pine Habitat Restoration			
10-30 year age class	• 4-8" DBH. • Stands dominated by Douglas-fir 50-80%, up to 1,500 tpa, with incense cedar, madrone, ponderosa pine and sugar pine from 20-40%. • Canopy closures are high, 80-100% with areas void of trees occupied by shrubs.	• 10-14" DBH. • Stands dominated by Douglas-fir 60-80%, up to 400 tpa with incense cedar, madrone, sugar pine 20-40% with scattered ponderosa pine. • Canopy closures are high, 80-100%. • Increase in small diameter snags and coarse woody debris up to 8" DBH.	• 12-16" DBH. • Stands up to 200 tpa with a mix of ponderosa and sugar pine, incense cedar, madrone, and Douglas-fir. • Canopy closures 80-100%. • Slight increase in snags and coarse woody debris up to 10" DBH.

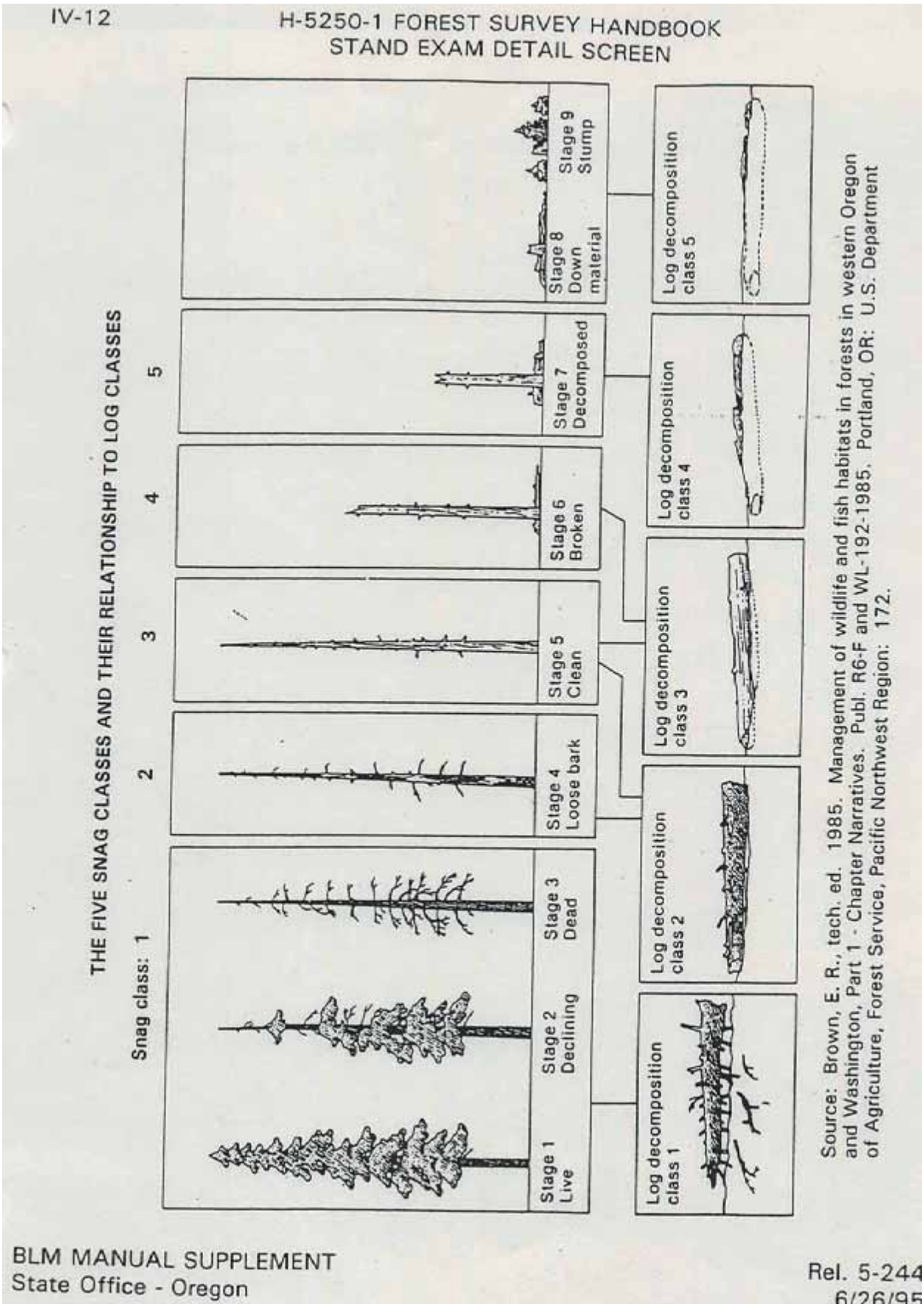
Table K –1. Sample Description of Potential Treatment Area by Restoration Activity

	Existing Conditions	Stand in 50 years No Action- Alternatives A, F	Stand in 50 years Alternatives B, C, D, E, G
30-80 year old stands	• 10-18" DBH. • Stands are a mix of Douglas-fir 40-70%, ponderosa pine, sugar pine, incense cedar and madrone 30-60% up to 300 tpa. • Canopy closures are 70-100%. Stand in stem exclusion stage, with scattered mortality of suppressed trees.	• 13-23" DBH • Stands are a mix of Douglas-fir 50-80%, ponderosa pine, sugar pine, incense cedar and madrone 20-50% up to 200 tpa. • Canopy closures 80-100% with fewer openings. • Increase in small diameter snags and coarse woody debris up to 14" DBH.	• 16-26" DBH. • Stands up to 100 tpa with a mix of ponderosa and sugar pine, incense cedar, Douglas-fir, and madrone. • Canopy closures 80-100% with small gaps. • Increase in snags and coarse woody debris up to 16" DBH.
Large > 20" pines	• Scattered large ponderosa and sugar pine > 20" DBH, 5-20 per acre. • Mixed stand of 3" DBH to 18" DBH, Douglas-fir, incense cedar, madrone, up to 1,000 tpa, with scattered sugar and ponderosa pine. • Canopy closures are 70-100%.	• Scattered large ponderosa and sugar pine > 24" DBH, 5-15 per acre. • Mixed stand 4"-22" DBH, with a species mix of Douglas-fir 60-80%, ponderosa pine, sugar pine, incense cedar and madrone 20-40% up to 200 tpa. • Canopy closures 80-100% with fewer openings. • Increase in small diameter snags and coarse woody debris up to 16" DBH.	• Scattered large ponderosa and sugar pine > 28" DBH, 5-20 per acre. • Mixed stand 8-28" DBH, with a species mix of ponderosa pine, sugar pine, incense cedar, Douglas-fir, and madrone, up to 100 tpa. • Canopy closures 70-100% with canopy gaps around large pine. • Increase in coarse woody debris up to 18" DBH.
Riparian Reserve Thinning			
10-30 year age class	• 4-8" DBH. • Stands dominated by Douglas-fir 50-90%, up to 900 tpa, with incense cedar, madrone, big leaf maple, red alder, pacific yew, Oregon Ash and sugar pine from 10-40%. White fir and western hemlock are present above 3000'. • Canopy closures are 70-100%.	• 10-14" DBH. • Stands dominated by Douglas-fir 60-90%, up to 400 tpa. Incense cedar, sugar pine, madrone, big leaf maple, red alder, pacific yew, Oregon ash from 10-30%. White fir and western hemlock above 3000'. • Canopy closures 80-100% with fewer openings. • Increase in small diameter snags and coarse woody debris up to 8" DBH.	• 12-16" DBH. • Stands dominated by Douglas-fir 50-90%, up to 200 tpa. Incense cedar, sugar pine, madrone, big leaf maple, red alder, pacific yew, Oregon ash from 10-30%. • Up to 25 selected conifers dominant in stand, 14"-16" DBH. • Canopy closures 80-100%. • Slight increase in small diameter snags and coarse woody debris up to 10" DBH.

Table K –1. Sample Description of Potential Treatment Area by Restoration Activity

	Existing Conditions	Stand in 50 years No Action- Alternatives A, F	Stand in 50 years Alternatives B, C, D, E, G
30-80 year old stands	• 10-18" DBH • Stands are dominated by Douglas-fir 50-90%, up to 300 tpa, with sugar pine, incense cedar, madrone, big leaf maple, red alder, pacific yew, Oregon ash from 10-50%. White fir and western hemlock are present above 3000'. • Canopy closures are 70-100%	• 13-23" DBH. • Stands are dominated by Douglas-fir 70-90%, up to 200 tpa. Incense cedar, sugar pine, madrone, big leaf maple, pacific yew from 10-30%. Red alder and Oregon ash becoming suppressed. • Canopy closures 80-100% with fewer openings. • Increase in small diameter snags and coarse woody debris up to 14" DBH.	• 14-26" DBH with 12 per acre released conifers being the dominant overstory trees, and the unthinned areas similar to "no action." • Stands dominated by Douglas-fir 60-80%, up to 150 tpa. Incense cedar, sugar pine, madrone, big leaf maple, pacific yew from 10-30%. Red alder and Oregon ash retained in openings created around selected dominant conifers. • Canopy closures 70-100% with small gaps. • Increase in small diameter snags and coarse woody debris up to 16" DBH.

Figure K-1. Relationship of Snag Classes to Log Classes



Appendix L
Botany

Special Status Plants

Special Status Plant Categories

Threatened, Endangered, and Proposed plants (FT, FE, and FP)

Plant species formally listed by the US Fish and Wildlife Service (USFWS) protected under the Endangered Species Act. It is the policy of the BLM to conserve listed species and the ecosystems on which they depend (USDI 2001). To date, T&E species include only vascular plants.

State Threatened, Endangered, or Proposed (STO, SEO, SPO)

Plant species listed by the State of Oregon. BLM policy is to manage for the conservation of those species and to comply with state laws protecting them to the extent they are consistent with the Federal Land Policy and Management Act (USDI 2001).

Bureau Sensitive (BSO)

Plants that could easily become endangered or extinct within the State. BLM policy requires that any Bureau action will not contribute to the need to list any of these species (USDI 2001). The Sensitive Species list, which includes vascular plants, lichens, and bryophytes, is tiered to State fish/wildlife/botanical agencies' and Oregon Natural Heritage Program (ONHP) designations.

Bureau Assessment (BAO)

Plants not presently eligible for official federal or state status, but of concern in Oregon and Washington and, at a minimum, may need protection or mitigation from BLM activities (USDI 2001). These vascular plants, lichens, and bryophytes are also tracked by the ONHP.

Bureau Tracking (BTO)

Plant species for which the BLM wishes to collect data in order to enable an early warning for species that may become of concern in the future, species for which more information is needed to determine their status, or species that no longer need active management. Protection and mitigation of these vascular plants, lichens, and bryophytes is discretionary (USDI 2001).

Medford Watch (MW)

This is a unique category to the Medford District BLM. It includes vascular plants, lichens, and bryophytes that have no official designation, but for which the BLM wishes to track and collect data. Protection of these species is discretionary by the line officer.

Survey and Manage (S&M)

Species managed under the Northwest Forest Plan that fall into six categories based on characteristics of rarity, uncommonness, and practicality of pre-disturbance surveys (Table L-1).

Table L-1. Survey and Manage Categories

Relative Rarity	Pre-Disturbance Surveys Practical	Pre-Disturbance Surveys Not Practical	Status Undetermined
Rare	**Category A** • Manage all known sites • Pre-disturbance surveys • Strategic surveys	**Category B** • Manage all known sites • N/A • Strategic Surveys	**Category E** • Manage all known sites • N/A • Strategic surveys
Uncommon	**Category C** • Manage high-priority sites • Pre-disturbance surveys • Strategic surveys	**Category D** • Manage high-priority sites • N/A • Strategic surveys	**Category F** • N/A • N/A • Strategic surveys

Table L-2. Special Status Plants Mentioned in the Elk Creek Watershed Analysis and South Cascades LSR Assessment, but not Considered for Analysis

Species	Status	Reason Deleted From Suspected List
Allotropa virgata		No longer has special status
Asplenium septentrionale	BAO ONHP 2	No habitat - occurs on granitic rock at high elevations (7,500-10,050')
Boschniakia strobilacea		No longer has special status
Collomia mazama	ONHP 1	Not known to occur in Medford District, occurs near Crater Lake
Corallorhiza maculata		No longer has special status
Corallorhiza mertensiana		No longer has special status
Cupressus bakeri	BAO	Located in Lost Creek Watershed; one site only in Medford District
Eburophyton austinae		No longer has special status
Frasera umpquensis	BSO	Unlikely in project area; occurs at 4,500-6,500' elevation along the Rogue-Umpqua Divide
Hemitomes congestum		No longer has special status
Lewisia cotyledon var *cotyledon*		No longer has special status; *Lewisia cotyledon* var *howellii* could occur
Mimulus pulsiferae		No longer has special status
Mimulus pygmaeus Pygmy monkeyflower		No longer has special status
Monotropa uniflora		No longer has special status
Pityopis californica		No longer has special status
Pleuriscospora fimbriolata		No longer has special status
Pterospora andromedea		No longer has special status
Polystichum californicum California swordfern		No longer has special status
Rosa spithamea var *spithamea*		No longer has special status
Sarcodes sanguinea		No longer has special status
Sedum radiatum var *depauperatum*		No longer has special status
ONHP=Oregon Natural Heritage Program List 1, 2, 3, or 4		

Table L-3. Summary of Botanical Surveys Conducted in the Timbered Rock Project Area

Project	Year(s)	Vascular Surveys (acres)	Lichen and Bryophyte Surveys (acres)	Fungi Surveys (acres)	Survey Area
Silviculture treatments	1990-2001	2,646			Throughout watershed
Timber sale	1990	211			West side of watershed
Hazardous fuels reduction	1998	445			West side of watershed
S&M fungi sampling surveys	1998, 1999			20	Old growth stands in Sugarpine, Hawk, and Elkhorn creeks and along Elk Creek on USACE
S&M fungi strategic surveys	2001			138	Old growth stands throughout the LSR
Cypripedium fasciculatum surveys in old growth conifer stands	2000	93			Old growth stands throughout the LSR
Cooperative grazing project with USACE	2001	121			USACE lands along Elk Creek
Fritillaria gentneri survey	2002	47			USACE lands along Elk Creek
Cooperative project with private landowner	2002, 2003	160	160		Near Berry Rock
Proposed FMZ	2003	40	40		Boundary between Lost Creek and Elk Creek watersheds
Proposed salvage, LSR thinning and riparian thinning units	2003	4,136			Inside and outside Timbered Rock Fire perimeter
Proposed salvage units, helicopter landdings, and temporary roads	2003	120	120		Inside Timbered Rock Fire perimeter
S&M strategic surveys	2002	400	400		Deferred Morine Creek drainage
Total Acres		**8,319**	**720**	**158**	

Table L-4. Special Status Plants Documented in the Timbered Rock Project Area with Protection Measures (October 2003)

Scientific Name	Status	Number of Sites	Location and Ownership	Project	Protection Measures
Cimicifuga elata	Bureau Sensitive	1	T32S-R1W-S1 BLM and Umpqua National Forest	FMZ	No hand piles within population boundary; underburn OK when plants dormant and fire would not scorch soil
Cortinarius olympianus	S&M B	1	T32S-R1W-S27; BLM	no projects	none required
Cypripedium fasciculatum	Bureau Sensitive, S&M C	8	T33S-R1W-S1 (2 sites); BLM	no projects	none required
			T33S-R1W-S10 (3 sites;) BLM	no projects	none required
			T33S-R1W-S12 (2 sites); BLM	no projects	none required
			T33S-R1E-S21 (1 site); USACE	no projects	none required
Cypripedium montanum	Bureau Tracking, S&M C	6	T33S-R1W-S10 (1 site); BLM	no projects	none required
			T32S-R1E-S9 (1 site); BLM	no projects	none required
			T32S-R1E-S19 (1 site on road bank); BLM	road maintenance	no disturbance to bank within 25' of site
			T33S-R1E-S5 (1 site); BLM	salvage	100' no enter buffer
			T33S-R1E-S16 (1 site); USACE		none required
			T33S-R1E-S29 (1 site); BLM	no projects	none required
Fabronia pussila	Bureau Tracking	1	T33S-R1E-S15 (1 site); BLM	eagle habitat restoration	none required because of status, but no handpiles within 25'; underburn through site OK
Funaria muhlenbergii	Bureau Assessment	1	T33S-R1E-S15 (1 site); BLM	eagle habitat restoration	25' no-enter buffer
Iliamna latibracteata	Bureau Assessment	3	T32S-R1W-S1 (1 site); BLM	research (control unit)	none required because no treatment would occur
			T32S-R1W-S23 (2 sites); BLM	LSR thin	50' no-enter buffer
Limnanthes floccosa ssp *bellingeriana*	Bureau Sensitive	2	T33S-R1E-S15 (2 sites); BLM	eagle habitat restoration	no hand piles within 25'; underburn OK when plants are dormant and fire would not scorch soil
Perideridia howellii	Bureau Tracking	1	T33S-R1W-S24 (1 site); Private		none required
Plectania milleri	Bureau Tracking	1	T32S-R1E-S11 (1 site); BLM	no projects	none required
Ramaria rubripermanens	S&M D	2	USACE		none required
Sedum spathulifolium ssp *purdyi*	Bureau Tracking	1	T32S-R1E-S9 (1 site); BLM	fuels reduction in owl activity center	none required because of status, but no hand piles within 25'; underburn through site OK with flame lengths under 3'

Table L-4. Special Status Plants Documented in the Timbered Rock Project Area with Protection Measures (October 2003)

Scientific Name	Status	Number of Sites	Location and Ownership	Project	Protection Measures
Sulcaria badia	Bureau Sensitive	1	T33S-R1E-S24 (1 site); BLM	pine habitat restoration	50' no-enter buffer; low intensity underburn through site OK with flame lengths under 3'
Tortula subulata	Bureau Tracking	2	T33S-R1W-S10 (1 site); BLM	no projects	none required
			T33S-R1E-S21 (1 site); BLM	no projects	none required
Tremiscus helvelloides	S&M D	1	T32S-R2E-S29 (1 site); BLM	no projects	none required
Tripterocladium leucocladulum	Bureau Assessment	1	T33S-R1E-S24 (1 site); Private		none required

Table L-5. Special Status Plants Known or Suspected to Occur in the Elk Creek Watershed

Scientific Name	Status	Known/ Suspected	Habitat
Vascular Plants			
Cimicifuga elata Tall bugbane	BSO	Known	Openings in mature conifer stands; clearcuts; 4,300-5,400' elevation.
Cypripedium fasciculatum Clustered ladyslipper	BSO, SM C	Known	Variety of habitats. Moist to dry mixed evergreen forests, with heavy duff and filtered sunlight. May be tied to disturbance. 1,000-3,500' elevation.
Cypripedium montanum Mountain ladyslipper	BTO, SM C	Known	Mixed conifer and mixed evergreen/oak woodlands; north aspect; 60-80% canopy; 2,500-4,000' elevation.
Iliamna latibracteata California's wild hollyhock	BAO	Known	Moist, often shaded places, creek banks, disturbed areas, 1,500'-6,000' elevation.
Isopyrum stipitatum Siskiyou false rue anemone	BAO	Suspected	Chaparral slopes and foothills woodlands, 1,800-4,200' elevation.
Lewisia cotyledon var *howellii* Howell's lewisia	BTO	Known	Rock outcrops; full sun or partial shade; 2,000-4,000' elevation.
Microseris laciniata ssp *detlingii* Detling's silverpuffs	BSO	Suspected	Chaparral; grassy openings among oaks; shallow, clay soils,; <6,000' elevation.
Pellaea andromedifolia Coffee cliffbrake	BAO	Suspected	Rocky or dry areas; 90-5,400' elevation.
Perideridia howellii Howell's yampah	BTO	Known	Meadows; moist slopes; along streambanks; 900-4,500' elevation.
Ribes inerme var *klamathense* Klamath gooseberry	BTO	Suspected	Conifer forest edges; meadow edges; streamsides; 3,600-9,900' elevation.
Romanzoffia thompsonii Thompson's romanzoffia	BSO	Suspected	Rocky, moist seeps; usually on warm, south-facing slopes.
Scribneria bolanderi Scribner's grass	BTO	Suspected	Rocky scablands in chaparral or oak woodlands; 1500'-7500' elevation.
Sedum spathulifolium ssp *purdyi* Purdy's stonecrop	BTO	Known	Grows in thin mats of moss and soil or in gravel on rocky slopes and cliffs of granite or slate; 150-7,500' elevation.

Table L-5. Special Status Plants Known or Suspected to Occur in the Elk Creek Watershed

Scientific Name	Status	Known/ Suspected	Habitat
Lichens			
Leptogium rivale	SM E	Suspected	On rocks in small perennial streams in conifer forests.
Pannaria saubinetti	SM F	Suspected	Rocks or trees; moist or wet forests; in deep shade to somewhat open sites.
Ramalina thrausta	SM A	Suspected	On hardwoods, conifers or shrubs in open Oregon white oak/Douglas fir/poison oak plant association, sometimes with riparian influence, but dry habitats in the Butte Falls Resource Area.
Sulcaria badia	BSO	Known	Hardwoods in well-lit to partially-shaded situations in low elevations.
Bryophytes			
Crumia latifolia	BAO	Suspected	Wet rocks or cliff faces, usually calcareous.
Fabronia pusilla	MW	Known	Rock or bark, lowlands-7,100' elevation.
Funaria muhlenbergii	BAO	Known	Dry exposed soil, among rocks or on cliff ledges in open areas free from other vegetation, chaparral rocky scabland in Butte Falls Resource Area, low elevations.
Hedwigia detonsa	MW	Suspected	Dry, usually acidic rocks; river canyons; open forested lands (endemic to CA).
Hedwigia stellata	BTO	Suspected	Dry, usually acidic rocks, grasslands, savannas.
Tortula subulata	BTO	Suspected	Soil, especially on upturned root wads, disturbed sites.
Tripterocladium leucocladulum	BAO	Known	Shaded to exposed rocks, cliffs, and hardwood bark; low elevation.
Fungi			
Cortinarius olympianus	SM B	Known	Old growth conifer forests, soil and duff.
Ramaria rubripermanens	SM D	Known	Soil and duff.
Tremiscus helvelloides	SM B	Known	Soil over decaying wood under conifers.

Description of Special Status Plants Documented in the Timbered Rock Project Area (October 2003)

Vascular Plants

Cimicifuga elata (tall bugbane), Bureau Sensitive – One site was discovered by a Forest Service botanist during surveys prior to power-line maintenance. The population is located on a north-facing slope in moist mature forest on Umpqua National Forest Service and Roseburg BLM land, outside the Elk Creek Watershed. Only a small portion of the eastern edge of the population was affected by fire suppression efforts. A few plants were impacted by construction of a staging area and firelines, but most of the population was undisturbed. Many plants were observed intact after the fire was controlled. *Cimicifuga elata* is a long-lived perennial and western North America endemic whose range extends from southern British Columbia to Jackson County, Oregon. Eighty-five sites have been found in the Medford District; one in the Butte Falls Resource Area. Following a Conservation Strategy signed in 1996 and monitoring studies conducted throughout Oregon in the 1990s, the species was assessed as stable across its range. It has been found to respond favorably to disturbance and canopy removal (Kaye 2000a, 21). Part of the *Cimicifuga elata* site in Timbered Rock lies within a proposed fuel management zone that straddles the watershed boundary.

Cypripedium fasciculatum (clustered lady slipper), Bureau Sensitive and S&M C – Eight sites of this species have been discovered in the Elk Creek Watershed, all outside the fire perimeter. *Cypripedium fasciculatum* is a perennial orchid with shallow, rhizomatous roots and mycorrhizal associations. It occurs in a variety of habitats with a great diversity of soils, elevation, aspect, and plant communities (USDA and USDI 1998a, p 10). Approximately 530 sites are documented in the

Medford District; 69 of which are in the Butte Falls Resource Area. Although its distribution extends throughout the western United States, populations are widely scattered and disjunct with generally few plants per population. The Medford District BLM has by far the most number of sites within the Northwest Forest Plan area (Washington, Oregon, northern California). Studies indicate that *Cypripedium fasciculatum* may survive low to moderate severity fires. Recovery may take longer or may not occur after high severity fire that burns the duff layer, damages shallow rhizomes and associated mycorrhizal fungi, and removes or kills host trees (USDA and USDI 1998, 7; Applegate 2002, 3). None of the eight sites are located in proposed project areas.

Cypripedium montanum (mountain lady slipper), Bureau Tracking and S&M C – Like *Cypripedium fasciculatum*, *Cypripedium montanum* is a rhizomatous orchid that has a symbiotic relationship with a soil fungus. It is endemic to western North American where it is widely distributed, but most populations contain fewer than ten plants. Typical habitat is in mixed conifer or mixed evergreen/oak woodland plant communities with 60-80 percent canopy closure. The role and effects of fire on the species is unknown (USDA and USDI 1998a, 1-2). There are 206 known sites of *Cypripedium montanum* in the Medford District and 60 known sites in the Butte Falls Resource Area. Six sites have been documented in the project area. One site was known within the fire perimeter prior to the fire, on a ridge-line in an early seral conifer forest with residual 150 year old over story trees. The area burned at low severity, although a plantation next to it burned at high severity. When the site was discovered in 2001, eight plants were noted. When the site was revisited in 2003, no plants were visible. This site is outside any planned projects. Only one of the eight mountain lady slipper sites is located in a planned project unit (Table L-4).

Iliamna latibracteata (globe mallow), Bureau Assessment – Three sites of this species are known in the project area; two are west of the burned area and one is within the fire perimeter. *Iliamna latibracteata* is endemic to southwestern Oregon and northwestern California. Sites have been documented in Coos, Douglas, Josephine, and Jackson Counties in Oregon and Humboldt and Del Norte Counties in California. Typical habitat is moist, often shady places (Knight and Seevers 1992, 100). Thirteen sites have been discovered in the Medford District; ten of which are in the Butte Falls Resource Area. Several of the sites in Butte Falls are located in previously harvested areas along old skid roads, in clearcuts, and along road banks. It is a species that may require some disturbance to create a more open canopy within the forest. While the effects of fire on this species is unknown, a study on the closely related *Iliamna corei* in Virginia concluded that fire stimulates seed germination and maintains suitable habitat (Center for Plant Conservation March 12, 2003, 1). Only one site is located within a control research unit.

Limnanthes floccosa ssp *bellingeriana* (Bellinger's meadowfoam), Bureau Sensitive – Two sites were discovered in seasonally wet meadows on the east side of the project area. This spring-blooming plant grows in heavy clay soils where vegetation consists mostly of sparse annual grasses and forbs. Bellinger's meadowfoam is a Jackson County endemic that is closely related to the endangered *Limnanthes floccosa* ssp *grandiflora*. Thirty-seven sites have been reported in the Medford BLM Distrct; with twenty-one of those in Butte Falls Resource Area. Both sites are actually in the Lost Creek Watershed, but are located in a proposed eagle habitat restoration unit that straddles the watershed boundary.

Perideridia howellii (Howell's yampah), Bureau Tracking – This medium-size perennial plant occurs in wet drainages or meadows. 100 sites have been documented in the District and 29 in the Butte Falls Resource Area. The one site discovered to date in the Elk Creek Watershed is located on private land and was discovered during a survey for a cooperative project. Because it is a riparian species, *Perideridia howellii* is protected from most projects within riparian reserves. Although this site is on private land, it is likely that more sites would be discovered on BLM land.

Sedum spathulifolium ssp *purdyi* (Purdy's stonecrop), Bureau Tracking – One site has been reported within the Timbered Rock Fire perimeter on a rock outcrop in an early seral conifer forest with residual 150 year old overstory trees. The site burned at low severity and a revisit in 2003 found mosses on the rocks around the plants scorched, but the stonecrop plants intact. This sedum is endemic to the Klamath Mountains in southern Oregon and northern California and the Feather River drainage in the Sierra Nevadas. It is usually found in shade to partial shade on rocky slopes and cliffs (Hickman 1993, Knight and Seevers 1992, 188). Twenty-one sites are known in the Medford District, one of which is in the Butte Falls Resource Area. The site is in an area proposed for fuels treatment in an owl activity center.

Lichens

Sulcaria badia, Bureau Sensitive – One site of this epiphytic lichen was recently discovered on BLM land within the Elk Creek Watershed. Twenty-nine sites have been reported in the Medford District, although not all sites have been verified. Two sites have been verified in the Butte Falls Resource Area; one in Sams Valley and one in the Elk Creek Watershed.

Sulcaria badia is believed to be rare across its range, which extends from western Washington to northwestern California. It is also considered at risk because it occurs in lower elevations, particularly in proximity with agricultural lands where it has been affected by loss of habitat and could be affected by air pollution in some areas (McCune and Geiser 1997, 281). Typical substrate is the bark or wood of oaks, maples, or apple trees. *Sulcaria badia*'s response to fire is unknown, although it can be assumed that direct flames and smoke from a high intensity fire would negatively impact it. Even if specimens are not burned, heat and smoke may also impair its ability to perform photosynthesis. Because it occurs in the Butte Falls Resource Area in oak woodlands and these plant communities often burn at moderate to low intensity, however, it is possible that it may be adapted to a frequent, but low intensity fire regime.The site in the Timbered Rock project area is located in a proposed pine restoration unit.

Bryophytes

Fabronia pussila, Bureau Tracking – Typical habitat for this small bryophyte is on rock outcrops in xeric, harsh sites of open oak woodland, meadow, or chaparral habitats. It is endemic to western North America. 33 sites have been documented in the Medford BLM District, with 12 of those in the Butte Falls Resource Area. The site in the Timbered Rock project area is actually in the Lost Creek watershed in an eagle habitat restoration unit that straddles the watershed boundary.

Funaria muhlenbergii, Bureau Assessment – This bryophyte is less than a centimeter tall and is found, with difficulty, on mineral soil in chaparral scabland habitat, usually under the protection of rocks. It is a western U.S. endemic; 22 sites have been found in the Medford District, with 15 of those in the Butte Falls Resource Area. The one site documented to date in the project area is on the eastern side, in the Lost Creek Watershed, in an eagle habitat restoration unit.

Tortula subulata, Bureau Tracking – The range of this third diminutive bryophyte is the west coast of North America from B.C. to California. Typical habitat is in conifer stands on soil, often in disturbed sites such as upturned root wads, roadsides, and trails. 253 sites have been documented in the Medford District, with 50 of those in the Butte Falls Resource Area. The two sites found in the Timbered Rock project area are outside proposed projects.

Tripterocladium leucocladulum, Bureau Assessment – One site of this moss was recently discovered on private land during surveys for a cooperative project. At least 80 sites are known in the Medford District. It is a western North American endemic and it is found on soil, rock, or trees. It has not been well-studied and the effects of fire on this moss and its recovery mechanisms after fire are unknown. Even in low severity burn areas where the fire burned along the ground only, *Tripterocladium leucocladulum*, if present, could have been impacted.

Fungi

Cortinarius olympianus, S&M B – This fall-fruiting gilled fungus was discovered in one area in 2001 during surveys in the Elk Creek LSR that focused on detecting several genera, including this species. Six sites have been discovered in the Medford District; one of which is in the Butte Falls Resource Area. This fungi is endemic to the Pacific Northwest and is believed to be associated with old growth habitat. It grows in the soil in an ectomycorrhizal association with the roots of various conifers. Fire could harm populations as a result of disturbance to soil, duff, coarse woody debris, or mortality of host trees (Castellano and O'Dell 1997, 9-6).

Plectania milleri, Bureau Tracking – This small cup fungus that grows on soil and duff in old growth forests formerly had S&M status, but was removed from the list because it was determined not to be rare. It was retained on the BLM Special Status list as a Tracking species; information is collected if it is encountered, but sites are not protected. One site was discovered during fungi surveys in 1999 on BLM-administered land.

Ramaria rubripermanens, S&M D – This coral fungus was discovered on USACE land in 1999 by the Survey and Manage Fungi Taxa group from Oregon State University. It is endemic to the Pacific Northwest and is fairly abundant in Oregon, but less common in Washington and California; 74 sites are known in the Medford District. It fruits in both spring and fall in humus or soil and is ectomycorrhizal with various conifer species. The impacts of fire to the species depends on the severity of burn and damage to host trees, soil, and duff layers.

Tremiscus helvelloides (aka. *Phlogiotis helvelloides*), S&M D – One site of this jelly fungus was discovered in the Elk Creek Watershed during fungi surveys in 2001. Forty-one sites have been documented in the Medford District. This species is widely distributed, but uncommon where it occurs. It grows in forest stands in duff or humus and is ectomycorrhizal with conifer roots. As with the other fungi, impacts of fire to the species depends on burn severity and damage to host trees, soil, and duff layers.

Appendix M
Fuels

TIMBERED ROCK FIRE,
Medford District BLM and Rogue River National Forest
August 2002

Emergency Stabilization and Rehabilitation (ESR) and
Burned Area Emergency Rehabilitation (BAER)
Burn Severity Mapping

Methods and Definitions

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Mapping Methods:

The Timbered Rock fire occurred primarily on Medford District BLM Lands during August 2002 and totaled approximately 27,000 acres. Burn severity for the Timbered Rock fire was mapped with the aid of Landsat 7 satellite imagery (30 meter multi-spectral) acquired August 7, 2002.

BAER support staff at the USDA Forest Service Remote Sensing Applications Center (RSAC) in Salt Lake City procured the imagery from USGS EROS Data Center in Sioux Falls, SD (Landsat). RSAC staff then processed the imagery in Salt Lake City before delivering it to the BAER team in Grants Pass, Oregon, via ftp. This pre-processing included several steps:

1. The images were imported to ERDAS Imagine and georeferenced to UTM Zone 10, NAD27 for use with Rogue River National Forest and Medford BLM spatial datasets (GIS).
2. A band ratio was created from both images using the mid-infrared and near-infrared channels, since these have been shown to be sensitive to post-fire conditions.
3. The band ratios were classified and interpreted by RSAC staff. The resulting classifications were grouped into four burn severity classes: Unburned-Very Low, Low, Moderate, and High.
4. Next, a spatial overlay of pre-fire vegetation was used to adjust the classes to account for likely pre-fire fuel conditions.

An aerial reconnaissance via helicopter was conducted, and was followed by ground visits to validate the preliminary map. Adjustments were made based on aerial and ground observations.

Table M-1. Acres and Percent by Burn Severity Class

Burn Severity	Acres	Percent
High	2,798	10.3
Moderate	7,859	29.0
Low	8,477	31.3
Very Low/Unburned	7,927	29.3
	27,061	100.0

Burn Severity Class Definitions:

The Interagency Emergency Stabilization and Rehabilitation Manual set forth guidelines for mapping and identifying classes of burn severity. The Forest Service BAER website (http://fsweb.gstc.fs.fed.us/baer) contains a link to this manual, as well as documents, lesson plans, and presentations explaining burn severity classes and mapping techniques. These guidelines are followed, but each fire and each ecosystem has its own unique qualities that make a “one-size fits all” absolute definition impossible, and burn severity class definitions may vary slightly. For this reason, the following paragraphs describe the burn severity classes as they occur in the Timbered Rock fire area. It is important to recognize that the definitions of burn severity for BAER/ESR assessments are tied to changes in soil hydrologic function (infiltration, erosion hazard) and ecosystem impacts (revegetation potential, changes in vegetation community composition), and are NOT a direct reflection of vegetation mortality. Black stems where green trees once grew do not necessarily indicate high burn severity if the density of pre-fire fuels was not enough to lead to high heat and long residence times, both of which are generally necessary for high burn

severity. If timber stands were sparse, burn severity is most likely low or moderate. Even many shrub stands do not result in high burn severity since shrubs tend to be flashy fuels that burn quickly and have thin litter layers, thus short fire residence time.

Local landscape level differences in burn severity occurred in the burned area due to differences in soils, as well as vegetation type and density throughout the burned area. Another important factor was changing weather conditions during the period of burning.

Burn severity tends to be moderate or even low in those areas where soils are extremely rocky and pre-fire fuels were simply not heavy enough to support a severe fire for any length of time, such as grassland or light shrub stands. High burn severity tended to occur where there were denser stands of mixed conifer with thicker litter and duff layers. These generally occur in the Timbered Rock fire area on northerly slopes with deeper soils, and especially in the lower reaches of Flat Creek. Past fires from 1987 and other years burned in the area, and these former burns tended to result in low or moderate burn severity.

Based on field observations, aerial reconnaissance, and post-fire satellite imagery, the burn severity classes for the Timbered Rock fire can be generally described in the following paragraphs. Note: there are small unmapped inclusions of other burn severity classes in any given polygon, but the polygon should predominantly exhibit characteristics as described for its burn class. Minimum polygon size is approximately 5 acres.

Burn Severity Classes

Very Low/Unburned

These areas are a mosaic of unburned areas and very low severity ground fire. In these areas where pre-fire vegetation is forest or shrub, consumption of ground cover (litter and duff) and vegetation mortality is minimal. Overstory canopy remains vigorous and green. Mortality of trees and shrubs is slight. This includes large contiguous areas of rock outcrop or bare soils. Approximately 29% of burned area is Unburned-Very Low severity mosaic.

Low

Low burn severity is the dominant burn severity class in the Timbered Rock Fire, at approximately 31% of the burned area. Low burn severity dominates in areas where pre-fire fuels were sparse or light, such as grasslands, sparse trees or shrubs with thin litter and duff layers, and includes areas where smaller but common areas of rock outcrop or bare soil occur and contribute to the sparse nature of the vegetation. The fire probably spread rapidly but residence time was short due to paucity of ground and surface fuels. Amount of soil cover is not significantly reduced from pre-fire amount. Ample recognizable char is still evident in ash and char layers, as well as ample intact litter and duff, except in areas where none existed prior to the fire. Soil structure is not altered, fine and very fine roots still exist in surface soil, and surface 1mm or so of soil may or may not be weakly water repellant in places. Vegetation is lightly scorched, large trees are mostly not killed, and very small diameter fuels have been consumed. Forbs may be consumed or charred, but regrowth of vegetation will not be significantly inhibited. In most areas grass, forbs, and shrubs are already sprouting. Overall, adverse impacts to ecosystem and soil hydrologic function are slight to none. Ecosystems most likely benefited from the fire effects - thinning of fuels, release of nutrients, stimulation of fire-dependent vegetation species, creation of additional edge habitat and openings, and many other positive ecosystem benefits from low severity fire. Tree mortality may occur, but is slight.

Low severity can also occur in more densely forested areas if fire behavior was not extreme, such as night burns in forested areas, or areas at higher elevations where fire behavior conditions (wind, humidity) were not conducive to extreme behavior.

Post-fire runoff and erosion from areas of low burn severity are not expected to significantly increase over pre-fire rates.

Moderate

Moderate burn severity comprises about 29% of the Timbered Rock Fire. Moderate burn severity dominates in areas of moderately dense to dense shrub communities, in plantations, and in areas where hardwood or conifer tree species were moderately dense to dense, but brown needles remain on trees. In the case of shrub communities and plantations, the lack of thick pre-fire litter and duff layers resulted in rapid spread but relatively short residence time of fire. Shrub canopy may be all or partly consumed, shrub skeletons and root crowns remain, there is some identifiable char and litter beneath a thin ash layer, soil structure is intact, fine and very fine roots remain. Plantations may exhibit up to 100% mortality. The top

1mm or more of soil may or may not be water repellant in spots.

In areas where pre-fire vegetation consisted of hardwood or conifer trees, brown needles or leaves remain on trees, some identifiable char and litter may be present beneath the ash layer but much of the litter has been consumed. Soil structure is generally intact, fine and very fine roots remain, and water repellency may be significant or not. Fine fuels close to the ground may be all consumed and trees may exhibit 40 to 80 percent mortality or more. The importance of the potential for needlecast and leaf litter as brown needles and leaves fall to the forest floor and create natural mulch cannot be overstated.

Mulch is the single most effective post-fire treatment that can be done in areas of moderate or high burn severity to:

a) provide soil cover as protection from erosion by wind and water;
b) moderate surface soil temperature and moisture for seed and sprout regeneration (keeps soil surface cooler and more moist than areas lacking mulch),
c) slowing runoff rates and promoting infiltration, and;
d) re-introduction of organic matter for re-starting or continuing nutrient cycling vital to long-term soil productivity.

These areas where natural mulch potential exists are not likely to be treatment candidates, since natural processes will already provide the most effective treatment.

Post-fire runoff and erosion rates from forested areas with moderate burn severity will be increased from pre-fire levels. The amount of increase relates to the amount of needlecast (mulch) potential, amount of water repellant soils, soil type, amount of surface rock, and slope morphology.

Post-fire runoff and erosion rates from shrub ecosystems with moderate burn severity may be significantly increased over pre-fire rates, particularly the first storm season. In these areas, first-year runoff rates may approach those to be expected from high severity forest areas, but the recovery rate is much faster. By the second season following the fire, runoff and erosion from these moderate severity shrub areas will be significantly reduced due to vegetation recovery.

High

High burn severity is the least extensive class in the initial assessment area, at approximately 10%. It occurs in isolated small patches, and more extensively in a few watershed areas where pre-fire vegetation consisted of dense conifer or hardwood trees. Such areas include lower Flat Creek and along some east-facing slopes above Elk Creek at the southern end of the burned area. In these areas, pre-fire forest stands were denser, litter and duff were generally deeper, fire and heat residence time were longer, and nearly complete consumption of ground cover has occurred. The ash layer may be 1 to 2 inches deep. Some, but little recognizable char is evident beneath the ash layer. Soil structural stability may be reduced due to more complete consumption of soil organic matter. Fine and very fine roots may have been consumed in the surface few centimeters of soil. Water repellency is generally strong at the soil surface, and was observed in some places up to 1 to 2 inches below the surface. (It is important to note that even in unburned areas, soils may exhibit some water repellant characteristics due to the nature of the leaf and needle litter or abundance of fungal mycelia.) Complete consumption of tree crowns has occurred, few to no or leaves needles remain on trees, mortality can be assumed to be close to 100%.

Runoff and erosion are expected to be significantly increased over pre-fire levels for at least 3 to 5 years. Recovery of vegetative cover is expected to be slower in these areas of high burn severity.

FUEL MODEL DESCRIPTIONS
Grass Group

Fire Behavior Fuel Model 1

Fire spread is governed by the fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured. Fires are surface fires that move rapidly through the cured grass and associated material. Very little shrub or timber is present, generally less than one-third of the area.

Grasslands and savanna are represented along with stubble, grass-tundra, and grass-shrub combinations that met the above area constraint. Annual and perennial grasses are included in this fuel model. Refer to photographs 1, 2, and 3 for illustrations.

This fuel model correlates to 1978 NFDRS fuel models A, L, and S.

Fuel model values for estimating fire behavior

Total fuel load, < 3-inch dead and live, tons/acre	0.74
Dead fuel load, ¼-inch, tons/acre	.74
Live fuel load, foliage, tons/acre	0
Fuel bed depth, feet	1.0

Photo 1. Western annual grasses such as cheatgrass, medusahead ryegrass, and fescues.

Photo 2. Live oak savanna of the Southwest on the Coronado National Forest.

Photo 3: Open pine—grasslands on the Lewis and Clark National Forest

Shrub Group

Fire Behavior Fuel Model 4

Fire intensity and fast-spreading fires involve the foliage and live and dead fine woody material in the crowns of a nearly continuous secondary overstory. Stands of mature shrubs, 6 or more feet tall, such as California mixed chaparral, the high pocosin along the east coast, the pinebarrens of New Jersey, or the closed jack pine stands of the north-central States are typical candidates. Besides flammable foliage, dead woody material in the stands significantly contributes to the fire intensity. Height of stands qualifying for this model depends on local conditions. A deep litter layer may also hamper suppression efforts. Photographs 9, 10, 11, and 12 depict examples fitting this fuel model.

This fuel model represents 1978 NFDRS fuel models B and O; fire behavior estimates are more severe than obtained by models B or O.

Fuel model values for estimating fire behavior

Total fuel load, < 3-inch dead and live, tons/acre	13.0
Dead fuel load, ¼-inch, tons/acre	5.0
Live fuel load, foliage, tons/acre	5.0
Fuel bed depth, feet	6.0

Photo 9. Mixed chaparral of southern California; note dead fuel component in branchwood.

Photo 10. Chaparral composed of manzanita and chamise near the Inaja Fire Memorial, Calif.

Photo 11. Pocosin shrub field composed of species like fetterbush, gallberry, and the bays.

Photo 12. High shrub southern rough with quantity of dead limbwood.

Fire Behavior Fuel Model 5

Fire is generally carried in the surface fuels that are made up of litter cast by the shrubs and the grasses or forbs in the understory. The fires are generally not very intense because surface fuel loads are light, the shrubs are young with little dead material, and the foliage contains little volatile material. Usually shrubs are short and almost totally cover the area. Young, green stands with no dead wood would qualify: laurel, vine maple, alder, or even chaparral, manzanita, or chamise.

No 1978 NFDRS fuel model is represented, but model 5 can be considered as a second choice for NFDRS model D or as a third choice for NFDRS model T. Photographs 13 and 14 show field examples of this type. Young green stands may be up to 6 feet (2 m) high but have poor burning properties because of live vegetation.

Fuel model values for estimating fire behavior

Total fuel load, < 3-inch dead and live, tons/acre	3.5
Dead fuel load, ¼-inch, tons/acre	1.0
Live fuel load, foliage, tons/acre	2.0
Fuel bed depth, feet	2.0

Photo 13. Green, low shrub fields within timber stands or without overstory are typical. Example is Douglas-fir–snowberry habitat type.

Photo 14. Regeneration shrublands after fire or other disturbances have a large green fuel component, Sundance Fire, Pack River Area, Idaho.

Fire Behavior Fuel Model 6

Fires carry through the shrub layer where the foliage is more flammable than fuel model 5, but this requires moderate winds, greater than 8 mi/h (13 km/h) at mid-flame height. Fire will drop to the ground at low wind speeds or at openings in the stand. The shrubs are older, but not as tall as shrub types of model 4, nor do they contain as much fuel as model 4. A broad range of shrub conditions is covered by this model. Fuel situations to be considered include intermediate stands of chamise, chaparral, oak brush, low pocosin, Alaskan spruce taiga, and shrub tundra. Even hardwood slash that has cured can be considered. Pinyon-juniper shrublands may be represented but may overpredict rate of spread except at high winds, like 20 mi/h (32 km/h) at the 20-foot level.

The 1978 NFDRS fuel models F and Q are represented by this fuel model. It can be considered a second choice for models T and D and a third choice for model S. Photographs 15, 16, 17, and 18 show situations encompassed by this fuel model.

Fuel model values for estimating fire behavior

Total fuel load, < 3-inch dead and live, tons/acre	6.0
Dead fuel load, ¼-inch, tons/acre	1.5
Live fuel load, foliage, tons/acre	0
Fuel bed depth, feet	2.5

Photo 15. Pinyon-juniper with sagebrush near Ely, Nev.; understory mainly sage with some grass intermixed.

Photo 16. Southern hardwood shrub with pine slash residues.

Photo 17. Low pocosin shrub field in the south.

Photo 18. Frost-killed Gambel Oak foliage, less than 4 feet in height, in Colorado.

Timber Group

Fire Behavior Fuel Model 8

Slow-burning ground fires with low flame lengths are generally the case, although the fire may encounter an occasional "jackpot" or heavy fuel concentration that can flare up. Only under severe weather conditions involving high temperatures, low humidities, and high winds do the fuels pose fire hazards. Closed canopy stands of short-needle conifers or hardwoods that have leafed out support fire in the compact litter layer. This layer is mainly needles, leaves, and occasionally twigs because little undergrowth is present in the stand. Representative conifer types are white pine, and lodgepole pine, spruce, fir, and larch.

This model can be used for 1978 NFDRS fuel models H and R. Photographs 22, 23, and 24 illustrate the situations representative of this fuel.

Fuel model values for estimating fire behavior

Total fuel load, < 3-inch, dead and live, tons/acre	5.0
Dead fuel load, ¼-inch, tons/acre	1.5
Live fuel load, foliage, tons/acre	0
Fuel bed depth, feet	0.2

Photo 22. Surface litter fuels in western hemlock stands of Oregon and Washington.

Photo 23. Understory of inland Douglas-fir has little fuel here to add to dead-down litter load.

Photo 24. Closed stand of birch-aspen with leaf litter compacted.

Fire Behavior Fuel Model 9

Fires run through the surface litter faster than model 8 and have longer flame height. Both long-needle conifer stands and hardwood stands, especially the oak-hickory types, are typical. Fall fires in hardwoods are predictable, but high winds will actually cause higher rates of spread than predicted because of spotting caused by rolling and blowing leaves. Closed stands of long-needled pine like ponderosa, Jeffrey, and red pines, or southern pine plantations are grouped in this model. Concentrations of dead-down woody material will contribute to possible torching out of trees, spotting, and crowning.

NFDRS fuel models E, P, and U are represented by this model. It is also a second choice for models C and S. Some of the possible field situations fitting this model are shown in photographs 25, 26, and 27.

Fuel model values for estimating fire behavior

Total fuel load, < 3-inch dead and live, tons/acre	3.5
Dead fuel load, ¼-inch, tons/acre	2.9
Live fuel load, foliage, tons/acre	0
Fuel bed depth, feet	0.2

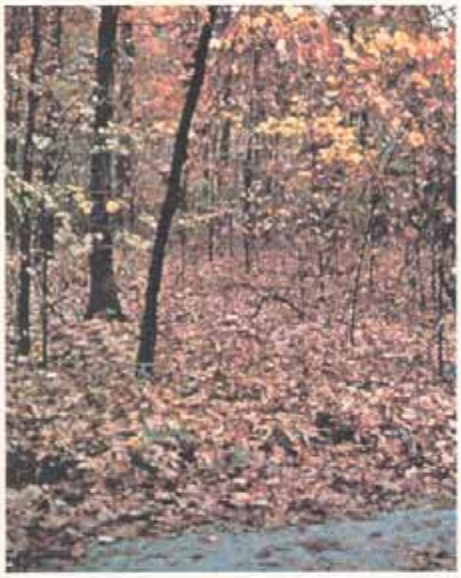

Photo 25. Western Oregon white oak fall litter; wind tumbled leaves may cause short-range spotting that may increase ROS above the predicted value.

Photo 26. Loose hardwood litter under stands of oak, hickory, maple and other hardwood species of the East.

Photo 27. Long-needle forest floor litter in ponderosa pine stand near Alberton, Mont.

Fire Behavior Fuel Model 10

The fires burn in the surface and ground fuels with greater fire intensity than the other timber litter models. Dead-down fuels include greater quantities of 3-inch (7.6-cm) or larger limbwood resulting from overmaturity or natural events that create a large load of dead material on the forest floor. Crowning out, spotting, and torching of individual trees are more frequent in this fuel situation, leading to potential fire control difficulties. Any forest type may be considered if heavy down material is present; examples are insect- or disease-ridden stands, windthrown stands, overmature situations with deadfall, and aged light thinning or partial-cut slash.

The 1978 NFDRS fuel model G is represented and is depicted in photographs 28, 29, and 30.

Fuel model values for estimating fire behavior

Total fuel load, < 3-inch dead and live, tons/acre	12.0
Dead fuel load, ¼-inch, tons/acre	3.0
Live fuel load, foliage, tons/acre	2.0
Fuel bed depth, feet	1.0

The fire intensities and spread rates of these timber litter fuel models are indicated by the following values when the dead fuel moisture content is 8 percent, live fuel moisture is 100 percent, and the effective windspeed at midflame height is 5 mi/h (8 km/h):

Model	Rate of spread *Chains/hour*	Flame length *Feet*
8	1.6	1.0
9	7.5	2.6
10	7.9	4.8

Fires such as above in model 10 are at the upper limit of control by direct attack. More wind or drier conditions could lead to an escaped fire.

Photo 28. Old-growth Douglas-fir with heavy ground fuels.

Photo 29. Mixed conifer stand with dead-down woody fuels.

Photo 30. Spruce habitat type where succession or natural disturbance can produce a heavy downed fuel load.

Logging Slash Group

Fire Behavior Fuel Model 11

Fires are fairly active in the slash and herbaceous material intermixed with the slash. The spacing of the rather light fuel load, shading from overstory, or the aging of the fine fuels can contribute to limiting the fire potential. Light partial cuts or thinning operations in mixed conifer stands, hardwood stands, and southern pine harvests are considered. Clearcut operations generally produce more slash than represented here. The less-than-3-inch (7.6-cm) material load is less than 12 tons per acre (5.4 t/ha). The greater-than-3-inch (7.6-cm) is represented by not more than 10 pieces, 4 inches (10.2 cm) in diameter, along a 50-foot (15-m) transect.

The 1978 NFDRS fuel model K is represented by this model and field examples are shown in photographs 31, 32, and 33.

Fuel model values for estimating fire behavior

Total fuel load, < 3-inch dead and live, tons/acre	11.5
Dead fuel load, ¼-inch, tons/acre	1.5
Live fuel load, foliage, tons/acre	0
Fuel bed depth, feet	1.0

Photo 31. Slash residues left after skyline logging in western Montana.

Photo 32. Mixed conifer partial cut slash residues may be similar to closed timber with down woody fuels.

Photo 33. Light logging residues with patchy distribution seldom can develop high intensities.

SOIL TEMPERATURE MODELING SCENARIOS USING A VARIETY OF FUEL LOADS*

SCENARIO 1 **SALVAGE**

Stand age is 15-30 years post Timbered Rock Fire.
Loadings as follows:
Program defaults were used. See computer run for loadings
40% of dead and down is rotten (FOFEM program default)
9 tons/acre used in scenario 1

SCENARIO 2 **NO SALVAGE**

Stand age is 15-30 years post Timbered Rock Fire.
Fuel loadings as follows:
11" to 18" dbh material 26 tons/ acre 75% available for consumption = 20 tons/acre
19" to 30" dbh material 42 tons/acre 50% available for consumption = 21 tons/acre
31" + dbh material 26 tons/acre 25% available for consumption = 7 tons/acre
40% of dead and down is rotten (FOFEM program default)
48 tons/acre used in scenario 2

SCENARIO 3 **NO SALVAGE**

Stand age is 30-60 years post Timbered Rock Fire.
Fuel loadings as follows:
11" to 18" dbh material 26 tons/ acre 90% available for consumption = 23.4 tons/acre
19" to 30" dbh material 42 tons/acre 75% available for consumption = 31.5 tons/acre
31" + dbh material 26 tons/acre 50% available for consumption = 13 tons/acre
40%of dead and down is rotten (FOFEM program default)
68 tons/acre used in scenario 3

SCENARIO 4 **NO SALVAGE**

Stand age is 60 years + post Timbered Rock Fire.
Fuel loadings as follows:
11" to 18" diameter material 26 tons/ acre 100% available for consumption = 26 tons/acre
19" to 30" diameter material 42 tons/acre 75% available for consumption = 38 tons/acre
31" + diameter material 26 tons/acre 50% available for consumption = 21 tons/acre
65% of dead and down is rotten (decay increased over time to simulate natural decay processes)
85 tons/acre used in scenario 4

*Fuel loadings were determined using an average of size classes of standing snags derived from stand exam data collected within the Timbered Rock Fire perimeter in the fall of 2002. Percentage of rot was varied by age to simulate decay class changes. Fuels were modeled with no duff layer to show effects of large wood on soil heating. Fuel loadings are derived from 3 inch and larger wood using FOFEM 5. Ages for breakpoints were determined by using information from Maser et.al. (1988)

FUEL LOADING CALCULATIONS FOR TIMBERED ROCK SOIL HEATING SCENARIOS

Fuel loadings were determined using an average of size classes of standing snags derived from stand exam data collected within the Timbered Rock Fire perimeter in the fall of 2002. This data represents a composite of a variety of site conditions, which are not site specific, but represents the fire area well as a whole. Each tree was broken down into log lengths and weights were determined from log weight table included in this appendix.

11" to 18"dbh *45 trees / acre*
14"X 18' = 498lbs or .25 tons
18"X 14' = 684 lbs or .34 tons

498X 45 = 22,410	11 tons/acre estimated
684X45 = 30,780	15 tons/acre estimated
	26 tons/acre estimated total load for size class

19" to 30" dbh *19 trees / acre*
30"X 20' = 2757 lbs or 1.38 tons
20"X 20' = 1170 lbs or .59 tons
14" X 20' = 540 lbs or .27

2757 X 19 = 52,383 lbs	26 tons/acre
1170 X 19 = 22,230 lbs	11 tons/acre
540 X 19 = 10,260 lbs	5 tons/acre
	42 tons/acre

31"+ dbh *9 trees/acre*
14" X 20' = 540 lbs or .27 tons
20" X 20' = 1170 lbs or .59 tons
36" X 20' = 4029 lbs or 2.01 tons

540 X 9 = 4,680	3 tons/acre
1170 X 9 = 10,560	5 tons/acre
4029 X 9 = 36,261	18 tons/acre
	26 tons/acre

Stand age 20 to 30 years

11" to 18"- 26 X .75 =	20 tons/acre
19" to 30"- 42 X .5 =	21 tons/acre
31"+ 26 X 25 =	7 tons/acre

Stand age 31 to 60 years

11" to 18"- 26 X .90=	23 tons/acre
19" to 30"- 42 X .75 =	32 tons/acre
31"+ - 26 X .50 =	13 tons/acre

Stand age 61 + years

11" to 18" – 26 X .100=	26 tons/acre
19" to 30"- 42 X .90 =	38 tons/acre
31"+26 X .80 =	21 tons/acre

TITLE: Results of FOFEM model execution on date: 4/26/2003

FUEL CONSUMPTION CALCULATIONS

Region: Pacific_West
Cover Type: SAF/SRM - SAF 234 - Douglas-fir - Tanoak - Pacific Madrone
Fuel Type: Natural
Fuel Reference: FOFEM 241

FUEL CONSUMPTION TABLE

Fuel Component Name	Preburn Load (t/acre)	Consumed Load (t/acre)	Postburn Load (t/acre)	Percent Reduced (%)	Equation Reference Number	Moisture (%)
Litter	0.50 -	0.50	0.00	100.0	999	
Wood (0-1/4 inch)	0.35 -	0.35	0.00	100.0	999	
Wood (1/4-1 inch)	1.05 -	1.00	0.05	95.1	999	10.0
Wood (1-3 inch)	0.75 -	0.32	0.43	43.2	999	
Wood (3+ inch) Sound	5.40	0.14	5.26	2.7	999	10.0
Wood (3+ inch) Rotten	0.60	0.06	0.54	9.2	999	10.0
Duff	0.00 u	0.00	0.00	0.0	2	40.0
Herbaceous	0.20	0.20	0.00	100.0	22	
Shrubs	0.52 +	0.31	0.21	60.0	23	
Crown foliage	0.00 -	0.00	0.00	0.0	37	
Crown branchwood	0.00 -	0.00	0.00	0.0	38	
Total Fuels	9.37	2.88	6.49	30.8		

'u' Preburn Load is User adjusted
'+' Preburn Load is Heavy/Abundant
'-' Preburn Load is Light/Sparse

FIRE EFFECTS ON FOREST FLOOR COMPONENTS

Duff Depth Consumed (in) 0.0 Equation: 6
Mineral Soil Exposed (%) 50.8 Equation: 10

Soil Heat Report

Cover Type.....: SAF/SRM - SAF 234 - Douglas-fir - Tanoak - Pacific Madrone
Duff Depth.....: Pre-Fire: 0.00 cm., Post-Fire: 0.00 cm.

Soil Layer Maximum Temperature
(measurements are in centimeters and Celsius)

Depth	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Temp.	269	93	56	46	39	35	32	30	28	26	25	23	22	21
Time	10	18	21	28	39	53	67	83	96	106	113	118	120	1

Max Depth Having 60 degrees: 1
Max Depth Having 275 degrees: - None -

TITLE: Results of FOFEM model execution on date: 4/26/2003

FUEL CONSUMPTION CALCULATIONS

Region: Pacific_West
Cover Type: SAF/SRM - SAF 234 - Douglas-fir - Tanoak - Pacific Madrone
Fuel Type: Natural
Fuel Reference: FOFEM 241

FUEL CONSUMPTION TABLE

Fuel Component Name	Preburn Load (t/acre)	Consumed Load (t/acre)	Postburn Load (t/acre)	Percent Reduced (%)	Equation Reference Number	Moisture (%)
Litter	0.50 -	0.50	0.00	100.0	999	
Wood (0-1/4 inch)	0.35 -	0.35	0.00	100.0	999	
Wood (1/4-1 inch)	1.05 -	1.05	0.00	100.0	999	10.0
Wood (1-3 inch)	0.75 -	0.75	0.00	100.0	999	
Wood (3+ inch) Sound	28.80 u	11.23	17.57	39.0	999	10.0
Wood (3+ inch) Rotten	19.20 u	11.68	7.52	60.8	999	10.0
Duff	0.00 u	0.00	0.00	0.0	2	40.0
Herbaceous	0.20	0.20	0.00	100.0	22	
Shrubs	0.52 +	0.31	0.21	60.0	23	
Crown foliage	0.00 -	0.00	0.00	0.0	37	
Crown branchwood	0.00 -	0.00	0.00	0.0	38	
Total Fuels	51.37	26.07	25.30	50.7		

'u' Preburn Load is User adjusted
'+' Preburn Load is Heavy/Abundant
'-' Preburn Load is Light/Sparse

FIRE EFFECTS ON FOREST FLOOR COMPONENTS

Duff Depth Consumed (in) 0.0 Equation: 6
Mineral Soil Exposed (%) 50.8 Equation: 10

Soil Heat Report

Cover Type.....: SAF/SRM - SAF 234 - Douglas-fir - Tanoak - Pacific Madrone
Duff Depth.....: Pre-Fire: 0.00 cm., Post-Fire: 0.00 cm.

Soil Layer Maximum Temperature
(measurements are in centimeters and Celsius)

Depth	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Temp.	374	290	227	179	144	116	92	73	67	60	51	42	32	21
Time	72	82	104	130	147	184	196	152	157	166	174	180	187	1

Max Depth Having 60 degrees: 9
Max Depth Having 275 degrees: 1

TITLE: Results of FOFEM model execution on date: 4/26/2003

FUEL CONSUMPTION CALCULATIONS

Region: Pacific_West
Cover Type: SAF/SRM - SAF 234 - Douglas-fir - Tanoak - Pacific Madrone
Fuel Type: Natural
Fuel Reference: FOFEM 241

FUEL CONSUMPTION TABLE

Fuel Component Name	Preburn Load (t/acre)	Consumed Load (t/acre)	Postburn Load (t/acre)	Percent Reduced (%)	Equation Reference Number	Moisture (%)
Litter	0.50 -	0.50	0.00	100.0	999	
Wood (0-1/4 inch)	0.35 -	0.35	0.00	100.0	999	
Wood (1/4-1 inch)	1.05 -	1.05	0.00	100.0	999	10.0
Wood (1-3 inch)	0.75 -	0.75	0.00	100.0	999	
Wood (3+ inch) Sound	29.75 u	17.41	12.34	58.5	999	10.0
Wood (3+ inch) Rotten	55.25 u	44.66	10.59	80.8	999	10.0
Duff	0.00 u	0.00	0.00	0.0	2	40.0
Herbaceous	0.20	0.20	0.00	100.0	22	
Shrubs	0.52 +	0.31	0.21	60.0	23	
Crown foliage	0.00 -	0.00	0.00	0.0	37	
Crown branchwood	0.00 -	0.00	0.00	0.0	38	
Total Fuels	88.37	65.23	23.14	73.8		

'u' Preburn Load is User adjusted
'+' Preburn Load is Heavy/Abundant
'-' Preburn Load is Light/Sparse

FIRE EFFECTS ON FOREST FLOOR COMPONENTS

Duff Depth Consumed (in) 0.0 Equation: 6
Mineral Soil Exposed (%) 50.8 Equation: 10

Soil Heat Report

Cover Type.....: SAF/SRM - SAF 234 - Douglas-fir - Tanoak - Pacific Madrone
Duff Depth.....: Pre-Fire: 0.00 cm., Post-Fire: 0.00 cm.

Soil Layer Maximum Temperature
(measurements are in centimeters and Celsius)

Depth	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Temp.	478	402	337	284	240	201	167	134	101	72	63	52	38	21
Time	124	131	150	173	205	222	258	271	279	203	209	212	216	1

Max Depth Having 60 degrees: 10
Max Depth Having 275 degrees: 3

WEIGHTS IN POUNDS AND TONS FOR DOUGLAS-FIR WILDLIFE LOGS

LARGE END DIA "	LOG LENGH IN FEET 10		12		14		16		18		20	
	LBS	TONS	LBS	TONS	LBS	TONS	LBS	TONS	LBS	TONS	LBS	TONS
14	297	0.15	351	0.18	402	0.20	450	0.23	498	0.25	540	0.27
16	393	0.20	465	0.23	534	0.27	600	0.30	663	0.33	723	0.36
18	504	0.25	594	0.30	684	0.34	771	0.39	855	0.43	933	0.47
20	627	0.31	741	0.37	855	0.43	963	0.48	1068	0.53	1170	0.59
22	762	0.38	903	0.45	1041	0.52	1176	0.59	1308	0.65	1434	0.72
24	912	0.46	1083	0.54	1248	0.62	1410	0.71	1569	0.78	1725	0.86
26	1074	0.54	1275	0.64	1473	0.74	1668	0.83	1857	0.93	2043	1.02
28	1251	0.63	1488	0.74	1719	0.86	1944	0.97	2169	1.08	2385	1.19
30	1440	0.72	1713	0.86	1980	0.99	2244	1.12	2502	1.25	2757	1.38
32	1644	0.82	1956	0.98	2262	1.13	2565	1.28	2862	1.43	3153	1.58
34	1860	0.93	2214	1.11	2562	1.28	2907	1.45	3246	1.62	3576	1.79
36	2088	1.04	2487	1.24	2883	1.44	3270	1.64	3651	1.83	4029	2.01
38	2331	1.17	2778	1.39	3219	1.61	3654	1.83	4083	2.04	4506	2.25
40	2589	1.29	3084	1.54	3576	1.79	4062	2.03	4539	2.27	5010	2.51
42	2859	1.43	3408	1.70	3951	1.98	4488	2.24	5019	2.51	5541	2.77
44	3141	1.57	3747	1.87	4344	2.17	4938	2.47	5520	2.76	6099	3.05
46	2438	1.22	4101	2.05	4758	2.38	5406	2.70	6048	3.02	6681	3.34
48	3747	1.87	4473	2.24	5190	2.60	5898	2.95	6600	3.30	7293	3.65
50	4071	2.04	4860	2.43	5640	2.82	6411	3.21	7176	3.59	7932	3.97
52	4407	2.20	5262	2.63	6108	3.05	6945	3.47	7776	3.89	8595	4.30
54	4755	2.38	5679	2.84	6594	3.30	7500	3.75	8397	4.20	9285	4.64
56	5118	2.56	6114	3.06	7101	3.55	8079	4.04	9045	4.52	10005	5.00
58	5496	2.75	6567	3.28	7626	3.81	8676	4.34	9717	4.86	10749	5.37
60	5886	2.94	7032	3.52	8169	4.08	9297	4.65	10413	5.21	11520	5.76

Appendix N
Wildlife

Northern Spotted Owl

Management Chronology and Monitoring History in Elk Creek LSR 224

1972 – Middle Creek (within the burn area) was the first owl site identified on Medford District by graduate student Eric Forsman, who expressed concern for the loss of old growth habitat.

January 1975 – The Oregon Wildlife Commission adopted a list of Threatened and Endangered wildlife for Oregon that included the spotted owl as Threatened.

January 1978 – The Interagency Spotted Owl Management Plan was completed. It was designed to protect 400 pairs statewide; 90 were assigned to Oregon BLM and 14 to the Medford District. The Timbered Rock site was one Spotted Owl Management Areas (SOMA) designated to maintain a 1200-acre management area with at least 300 acres in old growth. BLM monitored this site and several others opportunistically.

August 1982 – US Fish and Wildlife Service Region 1 completed a status review and included the owl on a Sensitive Species list.

1985 - Responding to a recommendation by Oregon Department of Fish and Wildlife (ODFW), the BLM added 55 owl sites statewide for protection. BLM personnel complete the first general survey of the watershed and identified several "new" sites. Master's student Kathy Nickell monitored an adult owl at the Miller Mountain site via radiotelemetry (Nickell 1986). Impetus for the study was owls here seemed to be nesting in other than stands of unentered old-growth. There were many partial-cut stands (of various densities) in older seral timber supported owl reproduction.

1986 – The Oregon State University (OSU) Co-operative Wildlife Research Unit (Frank Wagner) began a density study/ demographic study (Miller Mountain Study) utilizing radiotelemetry that includes the Timbered Rock Fire area. The study continued through 1990. The last major timber sales in the watershed (Flat Bottom, Oliver Springs) were sold in 1986 (logging contracts continued to 1990).

January 1987 – US Fish and Wildlife Service (USFWS) was first petitioned to list the species as endangered.

August 1987 – The lightning-caused Burnt Peak Fire burned east of Elk Creek. Burned volume was sold later that fall in the Hot Tatouche sale. No known owl activity centers were located in that fire area.

December 1987 – USFWS announced the decision that listing was not warranted.

June 1988 – The Ninth Circuit Court granted an injunction against sales in or near owl habitats.

November 1988 – The judge remanded the suit to USFWS, saying the decision not to list was "arbitrary and capricious."

December 1988 – USFWS reopened the status review for the species.

March 1989 – The District judge granted a preliminary injunction halting old growth timber sales.

March 1989 – USFWS published a Federal Register Proposed Rule 54(120) (pg 26666-77) to federally list the northern spotted owl as Threatened. The BLM added 12 more SOMAs statewide (to the previous 110) for protection.

May 1990 – The Interagency Scientific Committee issued its report (the ISC report), "A conservation strategy for the northern spotted owl" (Thomas, et al. 1990, 3), that protected 1,000 acres within a 2.1-mile radius of selected sites and coins the term "Habitat Conservation Area." Habitat Conservation Areas (HCA) proposed maintaining large blocks of habitat versus the previous strategy of protecting scattered individual sites. The burn area and Elk Creek Watershed are within a proposed HCA.

July 26, 1990 – USFWS published the Final Rule to list the northern spotted owl as a Threatened species (*Federal Register* Vol. 55, No. 123, 26114-26194). OSU began an expanded demographic study, which included the entire Elk Creek

Watershed. Repeated protocol surveys were run each year to locate and color band all owls in a density study area. Intensive fieldwork continued through 1996. The BLM hired crews of wildlife technicians to survey for owls across the Medford District.

January 15, 1992 – The Federal Register published the Final Rule to establish Critical Habitat for the owl (Federal Register Vol. 57, No. 10, 1796-1838).

April 1992 – USFWS released a Draft Recovery Plan for the Northern Spotted Owl, which recommended establishing 196 Designated Conservation Areas (DCA) across the range of the spotted owl. The burn area and Elk Creek Watershed are within a DCA, ". . . designed to support a population of 20 or more pairs of owls in habitat conditions that allow successful breeding and rearing of young." (pg IX).

April 1994 – The Northwest Forest Plan Record of Decision (NFP) was issued with Standards and Guides for management of owls. The plan established a network of Late-Successional Reserves (LSR) and 100-acre cores for owl sites in Matrix lands that had been identified by January 1, 1994.

NFP Introduction page A-3 refers to Critical Habitat " . . . the combination of, and standards and guidelines for, Late-Successional Reserves, Managed Late-Successional Areas, Riparian Reserves, and matrix, should allow critical habitat to perform the biological function for which it was designated. Any site-specific considerations of critical habitat in the matrix are considered minimal, and will be evaluated through watershed analysis and addressed in area-specific plans, as appropriate." "Late-Successional Reserves are identified with an objective to protect and enhance conditions of late-successional and old-growth forest ecosystems, which serve as habitat for late-successional and old-growth related species including the northern spotted owl. Limited stand management is permitted, subject to review by the Regional Ecosystem Office" (pg A-4).

June 1995 – The Medford District Record of Decision and Resource Management Plan was published. Management for spotted owls is referenced on pages 4, 32, 33, 55, 57, and 195.

1997 – Boise Corporation personnel began monitoring many of the known owl sites in the watershed. BLM biologists covered the remaining sites. Due to budget constraints, some sites were monitored opportunistically versus a more rigid protocol. Collection of demographic data, and color banding of adults and young continued through the 2002 nesting season.

1999 – A meta-analysis of range-wide status of the owls was published, which included data from a Cascades Study Area just east of the Elk Creek area (Franklin, et al. 1999).

2001 – In response to lawsuits, USFWS reanalyzed the spotted owl baseline and reiterated the role of LSRs in lieu of a Recovery Plan. The report discussed the decreased importance of designated critical habitat areas outside of LSRs.

April to July 2002 – Boise and BLM personnel continued to monitor known sites in the BLM watershed (LSR 224). This was the 17th year of banding owls and gathering demographic performance data such as site fidelity (adult turnover), adult movements between sites, and production of young.

July to September 2002 – The Timbered Rock Fire burned 27,000 acres within the Elk Creek Watershed.

2003 – BLM and Boise conducted a complete resurvey of the burn area in April-May-June to determine the survival and location of the pre-fire owls.

Northern Spotted Owl Life History

Background

This section is intended to provide supplemental information on spotted owl life history to aid in the decision making process.

Preferred Prey within Elk Creek

Eight regurgitated pellets from three spotted owl sites within the Elk Creek Watershed collected from 1987 to 1992 contained bones and skulls from woodrat, flying squirrel, gopher, mole, deer mouse (Matt Broyles, pers com. 2003). Pellets were collected at the Middle Creek site from 1973-1978 that contained 22 woodrat, 10 mole, 8 flying squirrel, 8 vole (Eric

Forsman, pers com. 2002).

Foraging

"The most important stand structures in influencing habitat use were the amount of woody debris and, less consistently, the number of large snags at foraging sites and large-diameter trees at nest sites. The direct connection of standing and downed dead trees to owl biology probably occurs through the relationship between dead wood and the owl's prey" (northern flying squirrel) (Irwin, et al. 2000, 183). Many other small forest mammal prey of spotted owls also are associated with coarse woody debris on the forest floor, such as woodrats, deer mouse, Townsend's chipmunk, and western red-backed vole.

In northwestern California, owls selected the dusky-footed woodrat over other prey species. In general, foraging sites were near the ecotone between late and early seral mixed-conifer forests (Ward, et al. 1998, 88).

"As predicted, owls preferentially used units of young forest near their core areas when dusky-footed woodrats were present but only used young forests from time to time when flying squirrels were their primary prey" (Carey and Peeler 1995, 237).

"Simply, some young stands have more old-growth legacies than other stands, some develop faster than others and some are colonized by potential prey faster than others… Here, we found the owls were capable of selecting from among the young stands and using some of them consistently and intensively. This conclusion offers support for habitat restoration efforts as part of a strategy for the recovery of the spotted owl" (Ibid, 237).

"[S]ome level of timber harvest may benefit spotted owls because dusky-footed woodrats reach their highest abundance in sapling/brushy poletimber stands." "…when regenerating clearcuts are treated to remove competing vegetation, retention of hardwood brush and patches (>5-10 m wide) that do not significantly suppress conifer growth could provide suitable habitat for woodrats. In young sawtimber stands, implementing specific silvicultural treatments, such as precommercial thinning operations to maintain small patches or strips of brushy vegetation, may support small woodrat populations in a seral stage in which they are normally rare" (Sakai and Noon 1993, 380).

"Owls do not forage in these habitats [brush-stage clearcuts], presumably because the abundant prey are unavailable to them. To create brushy poletimber stands that do benefit owls, some demographic rate of owls, such as reproduction, must be limited by prey availability; woodrats within brushy poletimber stands must travel from source areas into older stands; and the brushy poletimber stands must be adjacent to stand types used for foraging by spotted owls" (Ibid, 380).

Home Range Size

In the 1986-1989 telemetry study in Elk Creek (the Timbered Rock fire area) the mean cumulative home range for 21 individual owls at seven sites was 4,060 acres. Home ranges expanded in winter. Home range overlap between seven neighboring pairs ranged from 34 to 78% (Wagner and Meslow 1989, 5-6).

Breeding season home ranges (minimum convex polygon) for 9 radiotagged adult owls near Roseburg ranged from 1,240 acres to 1,660 acres. Nonbreeding season ranges were larger, averaging 3,400 acres. Individual owls' home ranges were 25-75% old-growth. Owls foraged and roosted in old-growth significantly more than expected based on availability (Carey et al. 1990, 14).

Summer home ranges for 8 owls in northern California ranged from 450 to 1,630 acres, smaller than most other studies. On average, adjacent pairs shared 52 % of their home ranges, higher than estimates for other studies, probably due to patchy distribution of suitable habitat (Solis and Gutierrez 1990, 746).

Nest Site Selection

Hershey, et al. compared 105 nest sites with 105 random sites in western Oregon and on the Olympic Peninsula. There are conflicting results on the importance of large volumes of down woody debris, but owls appeared to be selecting nest sites with large basal area of broken-top trees. "In this study, we found the density and basal area of broken-top trees was lowest in the Klamath province, and most nest sites (67%) in the Klamath showed either evidence of mistletoe infestation or logging in which large trees were removed. In the absence of large broken-top trees or large trees with side cavities, and particularly where mistletoe infestation was prevalent, platform nests appeared to provide a suitable nesting structure" (Hershey, et al. 1998, 1404).

"This study suggested older forests associated with spotted owl nest sites possessed particular structures such as high tree densities in various DBH and height classes and high basal area of large broken-top trees that may not be present in all patches of older forest. Retention or development of these structures should be promoted if the objective is to manage for nesting habitat for spotted owls" (Ibid, 1408).

From a study on the Willamette National Forest, "Our analyses suggest spotted owl nests were associated with clumped distributions of old forest and indicated the influence of old forest on nest-site selection was greatest near the nest [within 200 yds]" (Swindle et al. 1999, 1219).

"The trend of increased association of old forest with decreased distance from the nest is biologically intuitive, from an energetics standpoint, for central-place foraging species like spotted owls. Additionally, use of large areas of old-forest habitat is understandable for a species that tends to specialize on medium-sized prey items that occur at low densities…, especially on a landscape that primarily consists of either unmanaged older forests or young plantations" (Ibid, 1219).

"The common assumptions that a core area is important for spotted owls, and sensitivity to habitat loss is greater closer to the nest site, are supported by this study. On our study area, the landscape scales of most pertinence to spotted owl nest-site location when considering the proportion of old forest seem to be (in descending order) (1) the surrounding 10-15 ha (appprox 200 m radius) …, (2) the surrounding 30-115 ha (approx 300-600 m radius) …, (3) the surrounding 200 ha (800 m radius) …" (Swindle, et al. 1999, 1220). These circles correspond to approximately 25 to 35 acres, 75 to 275 acres, and ½ mile radius. "These results do not indicate that old-forest habitat beyond 800 m from a nest site is unimportant to spotted owls."

From another study on the Willamette NF, owls nested in trees as young as 41 years, although 65% of nest trees were older than 120 years. "Suitable nesting habitat might best be facilitated via retaining legacy trees" (Irwin, et al. 2000, 175).

LaHaye and Gutierrez 1999 found the majority of their spotted owl nests in northwestern California on the lower portions of slopes. "Spotted Owls in this study selected nesting habitats with a large-diameter conifer overstory which contained a significant component of deformed trees and was subtended by an understory of large hardwoods. These results, coupled with high variation in tree diameters in nesting areas, demonstrate that the owls are using more complexly structured forest of older age than was available in the landscape" (Ibid, 329).

Suitable Habitat Rating

To enable mapping of where owl habitat was pre-fire, Operations Inventory polygons were given an owl habitat suitability rating (sometimes referred to as a McKelvey Rating) from 1 to 6. As detailed in the Elk Creek Watershed Analysis Data Element Appendix page 27:

"Class 1 – Meets all life requirements (optimal). Nesting, foraging, roosting and dispersal. Canopy closure greater than 60 percent. Canopy structure usually multi-layered and diverse and includes snags, mixed species and large 'wolf trees.'"

"Class 2 – Meets foraging, dispersal, and roosting. Canopy closure greater than 60 percent. Open enough below canopy to permit flight. Canopies can be single layered."

Class 1 & 2 (Habitat 1&2) together are considered "suitable owl habitat" nesting, roosting foraging (NRF).

"Class 3 – Meets no known requirements for spotted owls. Doesn't provide nesting, foraging, roosting, or dispersal. Canopy closure 40 percent or less. Doesn't meet requirements due to some kind of disturbance but has the biological potential to develop into class 1 or 2." This class includes clearcuts, plantations, thinned timber that could grow into suitable habitat given enough time.

"Class 4 – Meets no known requirements for spotted owls. Doesn't provide nesting, foraging, roosting or dispersal. Canopy closure 40 percent or less. Doesn't meet requirements due to site limitations and would not likely have the potential to develop into class 1 or 2. Examples could include oak woodlands, serpentine areas, etc." Other examples include roads, rockpits, brushfields – non forest, or very low stocking.

To enable quantification and display of dispersal habitat, Class 5 was created as a subset of Class 3, and Class 6 was created as a subset of Class 4. These stands feature scattered clumps of cover that could offer short-term roosting cover to owls as

they disperse across the landscape.

"Class 5 – Provides for spotted owl dispersal habitat only. Canopy closure between 40 and 60 percent. Needs to be open enough below canopy to allow for flight and avoidance of predators. Has the biological potential to develop into nesting, foraging or roosting habitat."

"Class 6 – Provides for spotted owl dispersal habitat only. Canopy closure between 40 and 60 percent. Needs to be open enough below canopy to allow for flight and avoidance of predators. Not currently meeting nesting, roosting or foraging requirements due to site limitations and would not likely have the potential to develop into class 1 or 2. Examples could include low site lands, woodlands, serpentine areas, etc."

For the Timbered Rock post-fire analysis, two new classes were created to depict habitat where most of the timber remains, but underburning degraded habitat for the prey base, estimated to recover in 2-5 years. Class 7 – is a subset of class 1. Class 8 – is a subset of class 2.

Role of Edge versus Core Habitat

"Spotted owl sites within the BLM checkerboard patterned lands in western Oregon were characterized in general by a larger proportion of old growth and by larger average and maximum sizes of old-growth patches than occurred at random on the forested landscape. Thus, site selection primarily was determined by the amount of old forest and the size of old-growth patches" (Meyer, et al. 1998, 46).

The view through the 1990s emphasized that spotted owls mainly used blocks of older forests. "…spotted owls are rare, and have low productivity, in 50-80 –year-old forests or areas with only the small amounts of older forest left after timber harvest activities. Owls were virtually absent in 50-80-year-old forests" (Bart and Forsman 1992, 99).

By the late 1990s, some researchers found that edge could be an important component of owl habitat use.

"…(S)urvival is maximized by maintaining relatively large core areas of habitat with some edge… In contrast, fecundity was maximized by minimizing core area of spotted owl habitat, maximizing the amount of edge between spotted owl and other habitats, and either minimizing or maximizing the number of discrete patches of spotted owl habitat…" (Franklin, et al. 2000, 573).

That observation is in contrast to the findings of Anthony, et al. (2002, 47) "… the amount of edge was not important to owl survival in our study." "Apparent survival of spotted owls was best explained by the percent of all old forest habitat at the core scale (positive effect) and the proportion of unsuitable habitat at the ring scale (negative effect)" (Ibid, 46).

Forest Thinning

Referring to commercial thinning in the Sierras, "We would not be surprised to find that a brief period (probably less than 5 years) elapses after logging operations before the owls resume foraging in selected timber stands" (Verner et al. 1992, 25).

Again in the Sierras, "Overly dense stands are subject to extensive mortality from drought and insects, including loss of the most desirable large, old trees." "Without substantial increases in funding for prescribed burning, the likelihood of losing large acreages of owl habitat to severe wildfires will increase over time" (Weatherspoon et al, 1992, 253).

In a radio-telemetry study on one owl near Eugene, "After commercial thinning, the nonbreeding season home range size was more than twice the size of that during preharvest and became less concentrated … as the owl visited areas further … than had been previously recorded" (Anthony 2001, 11). "When two years of data were combined, core use areas during the breeding seasons after harvest did not expand in size, but shifted north, excluding much of the thinned stand" (Ibid, 12).

"Although thinning treatments may eventually encourage forest development suitable for spotted owl use, the overall proportion of locations recorded in the thin for two years after harvest (3.8%) was approximately the same as that of clearcut/sapling stands (i.e. unsuitable owl habitat) in the area (4.2%) during the same period. Therefore, heavy thinning of conifers may have a negative short-term effect on spotted owl use of such stands" (Ibid, 15)

A study compared truffle abundance and species diversity between legacy stands versus thinned stands relative to use by flying squirrels and Townsends chipmunks (spotted owl prey). Some truffle species were found more in the thinned stands,

but most of the truffle species were more diverse in the legacy forests, implying that the unthinned stands would be better for those species of owl prey (Carey et al, 2002, 148).

"One factor that may also affect an owl's home range and habitat use over time is the home range and habitat use of other owls on adjacent breeding territories. Specifically, occupancy, movements and turnover on adjacent territories may contribute to change in size and location of a spotted owl's home range and habitat use over time" (Ibid, 13).

Dispersal

From a telemetry study of juvenile dispersal in west central and southwest Oregon, "Only 2 habitat parameters significantly affected the probability of mortality during dispersal; an increased use of open sapling stands during transience decreased the probability of mortality …, whereas an increased use of clearcuts during colonization increased the probability of mortality" (Miller, et al. 1997, 145). The mean straight line daily transient dispersal distance was one mile (Ibid, 147). Owls selected closed-canopy forests over open-canopy forests during transience, and more so for the colonization phase of dispersal. "Dispersing juvenile owls selected equally between less fragmented forests and more fragmented forests" (Ibid, 147).

Prey availability probably is a critical factor during dispersal, because many dispersing spotted owls die from starvation. A possible explanation for the decreased mortality associated with open sapling stands is that they could provide a relatively high source of prey (dusky-footed woodrat) compared to other habitats. Woodrats disperse from open sapling stands into older forest stands, so the sapling stands are beneficial to owls if prey availability is limiting (Miller et al, 1997, 147).

In a study of dispersal behavior of over 1400 spotted owls utilizing color banding and radio-telemetry, most juveniles in Oregon began to disperse from 17-21 September. Siblings dispersed independently, with a series of rapid movements away from the natal area in the first few weeks. The median dispersal distance for males was 9 miles, and 15 miles for females. Approximately 8 percent of young dispersed over 30 miles. "Forested landscapes traversed by dispersing owls typically included a fragmented mosaic of roads, clear-cuts, non-forest areas, and a variety of forest age classes ranging from young forests on cutover areas, to old-growth forests > 250 years old" (Forsman, et al. 2002, 2).

Productivity

Production of young (fecundity) can vary greatly from year to year. It is theorized that regional weather conditions influence owl nesting success.

"…[S]potted owls may employ a life history strategy similar to 'bet hedging' by which selection favors adult survival at the expense of present fecundity when the recruitment of offspring is unpredictable from year to year…" (Franklin, et al. 2000, 576).

Some owl populations may experience declines for several years of low productivity, then undergo an "apparent breeding pulse" every 3 to 5 years that sustains the population (Seamans et al. 2001, 429).

"…[T]he period when life history traits for Northern Spotted Owls are generally affected by climate is during the spring rather than the winter." "A plausible mechanism during this energetically stressful period [nesting] is that precipitation may decrease hunting efficiency, prey activity, and prey populations…" "Owl populations may experience periods of decline caused solely by climatic variation … even if habitat conditions remain unchanged" (Franklin et al. 2000, 576-577).

Owls and Fire

"The Forest Plan acknowledges the potential for the loss of owls and habitat from catastrophic events such as wildfire … and established S&Gs to address these concerns through appropriate management such as prescribed fire and other fuel treatments to reduce risks. Although these types of treatments in and around LSRs are typically designed to protect owl habitat over the long term by reducing the likelihood of catastrophic effects, in the short term prescribed fire can adversely affect nesting owls directly or indirectly by affecting their prey" (USDI, USFWS 2001, 11).

"…[M]any of the spotted owl habitats that developed as a result of fire exclusion and many others are at high risk of catastrophic fire unless treated" (Irwin and Thomas 2002, 4).

"Excessively dense understories may impede foraging and, to the extent that diversity of tree species – to include pines and oaks – is important, continued exclusion of fire may be degrading habitat quality." "Nevertheless, it is possible that fire exclusion in Sierran mixed-conifer forests has led to a net improvement in spotted owl habitat there." "If owl habitat has

improved as a result of fire suppression, such improvement may well be illusory and short-lived. Fire is inevitable in these forests, and the probability of catastrophic fire – certainly one of the greatest threats to owl habitat – increases as surface fuels and ladder fuels continue to accumulate" (Weatherspoon, et al. 1992, 253).

In a case study near Yakima WA, radiotagged spotted owls were monitored before and after two 1994 wildfires. At one site, "20% of post-fire locations fell within areas affected by low and medium intensity fires, suggesting that the habitat retained some degree of suitability." At another site, "the male's habitat use shifted dramatically away from the burned area…, which burned with low to high intensity all around and through the former nest grove." Following the fire, he "shifted his activity center to areas of predominantly suboptimal owl habitat outside of the burned area." "He continued to make occasional forays into the burned area, particularly the lightly burned portions" (King et al. 1998).

"Our observations indicate that smoke alone will not necessarily drive spotted owls off their territories. Even fire in close proximity, and very high levels of disturbance associated with fire-fighting, did not force the Bullgrouse female to abandon her young." "Habitat quality may decrease following low intensity fire, but is not necessarily destroyed. However, high intensity fire appears to be incompatible with maintenance of spotted owl habitat." "It is possible that habitat quality will continue to decline within the next few years, particularly in providing spotted owls with cover from avian predators, but the long-term trend should then be towards habitat improvement" (King et al. 1998). At the Bullgrouse site, a new pair moved in the year after the fire, and nested in 1996 and 1997 within 100 m. of the previous pairs nest.

"Controlled burning under conditions chosen by managers should be more successful in maintaining spotted owl habitat, while still carrying some risk of displacing owls and/or unacceptably degrading habitat quality. Close to active site centers, these risks are probably unacceptably high" (King, et al. 1998).

Barred Owls

The first barred owls were documented in Oregon in 1974 (Taylor and Forsman 1976). In portions of Washington, barred owls now outnumber spotted owls. Barred owls have a more diverse prey base, including more mammal species (snowshoe hare), more birds (grouse), and more diurnal prey. They also utilize riparian prey such as frogs and minnows. Although both species hunt in the forest, the barred owl is more of a generalist, making greater use of meadows and riparian areas, as well as forested areas (Hamer, et al. 2001, 225).

Barred owls weigh more than spotted owls. Barred owls have smaller home ranges. Barred owls rigorously defend their home range throughout the year. "The extremely large home range of the spotted owl may make an active and regular defense of home range impossible" (Hamer 1988, 59).

In a comparison of 62 spotted owl and 33 barred owl site centers (½ mile radius) in the western Cascades of Washington (Herter and Hicks 2000, 283-284), spotted owl sites contained more old forest closer to the site center. Barred owl sites persisted in areas of less old forest.

Dark, et al. (1998, 55) describe an instance where a spotted owl was apparently killed by a barred owl.

The potential for barred owl impacts on spotted owl viability in SW Oregon was addressed by USFWS in the BO (USDI, USFWS 2003, 23).

West Nile Virus

As of October 2003, West Nile Virus has not been detected in Oregon, but it has been detected in the neighboring states. Great horned owls and barred owls have succumbed to the disease (USDI, USFWS 2003, 25). The virus is a potential threat to spotted owl populations.

Population Trend

Based on a meta-analysis of data from 1985-1998 of 15 study areas that cover 23% of the range of the species, it is estimated that spotted owl populations have been declining approximately 4% per year (Forsman and Anthony 1999).

"Fitness in owls is a multistage process: (1) survival to reproductive age, (2) formation and maintenance of pair bonds and home ranges, (3) survival and maintenance of pair bonds and ranges in nonbreeding years, and (4) occasional successful reproduction that results in some young fledging, dispersing, maturing, and breeding" (Carey and Peeler 1995, 236).

Clarification on Critical Habitat Designation

The following are quotes from the Federal Register notice (43 pages) of the designation of Critical Habitat Units for the northern spotted owl. This information is the only guidance statement available from US Fish and Wildlife Service on how these lands should be managed and precedes the NW Forest Plan by two years (*Federal Register*, 50 CFR Part 17, Vol. 57 No. 10, Wed., January 15, 1992, pages 1796 – 1838).

Page 1796. "Critical habitat is defined ... as the specific areas ... on which are found those physical and biological features (i) essential to the conservation of the species, and (ii) that may require special management considerations or protection."

"... critical habitat serves to preserve options for a species eventual recovery. Critical habitat helps focus conservation activities by identifying areas that contain essential habitat features (primary constituent elements) regardless of whether or not they are currently occupied by the listed species ..." "Aside from the added protection provided under Section 7, the Act does not provide other forms of protection to lands designated as critical habitat."

Page 1797. "Specific management recommendations for critical habitat are more appropriately addressed in recovery plans, management plans, and through section 7 consultation." Primary Constituent Elements: "Such physical and biological features ... include, but are not limited to, the following: - Space for individual and population growth, and for normal behavior; - Food, water, or other nutritional or physiological requirements: - Cover or shelter; - Sites for breeding, reproduction, rearing of offspring; and - Habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species."

Page 1803. "The Service's primary objective in designating critical habitat was to identify existing spotted owl habitat and to highlight specific areas where management considerations should be given highest priority to manage habitat." "... the Service relied upon the following principles: - Develop and maintain large contiguous blocks of habitat to support multiple reproducing pairs of owls; - Minimize fragmentation and edge effect to improve habitat quality. - Minimize distance to facilitate dispersal among blocks of breeding habitat; and - Maintain range-wide distribution of habitat to facilitate recovery."

"The definition of 'suitable habitat' was generally equivalent to the structure of Douglas-fir stands 80 or more years of age (with adjustments for local variation or condition)." "Critical habitat units minimize distance between adjacent units, thereby facilitating dispersal and linkage."

Page 1804. "Since critical habitat designation is not a management plan, there was not a limitation on the size of the area added to any HCA ... Primary consideration was given to existing suitable habitat and known pairs of spotted owls, particularly where the Service felt that additional protection should be considered and would enhance the existing HCA."

Page 1805. "Although the designation of critical habitat emphasizes the importance of maintaining suitable habitat for all four constituent habitat elements, nesting and roosting habitat should be emphasized to improve opportunities for successful linkage." "Not all suitable nesting and roosting habitat was included in critical habitat."

Page 1806. "The emphasis for future management will be on maintaining or developing habitat that has the characteristics of suitable nesting and roosting habitat and to avoid or reduce the adverse effects of current management practices." "The Service analyzed the economic effects of the ... proposal to designate critical habitat."

Page 1809. "The revised proposed rule for the designation of critical habitat ... published on August 13 1991 ... encompassed a total of approximately 8.2 million acres." "As a result of the exclusion process, the Service is designating approximately 1.4 million acres less ..." "The final rule ... encompassing a total of nearly 6.9 million acres ... 62 percent of the total originally identified in the May 6 proposal." 1.2 million acres of Bureau land.

Page 1801. "State, private, tribal, and other non-Federal lands are not designated as critical habitat even if they are physically situated within the boundaries of critical habitat units."

Page 1822. "Section 7 prohibitions against the destruction or adverse modification of critical habitat apply to actions that would impair survival and recovery of the listed species, thus providing a regulatory means of ensuring that Federal actions within critical habitat are considered in relation to the goals and recommendations of a recovery plan. As a result of the link between critical habitat and recovery, the prohibition against destruction or adverse modification of the critical habitat should provide for the protection of the critical habitat's ability to contribute fully to the species' recovery."

Table N-1. Site Monitoring History for Spotted Owl Sites – 5 Year Occupancy and Productivity

Master Site #	Site Name	1998	1999	2000	2001	2002	Adult color confirmed in 2002
Active sites with center of activity on BLM within the burn							
2001	Alco Creek	M	NR	P, –, NB	P, –, NB	P, L, 0	M -
2012	Alco Rock	P, L, 0	P, L, 1	P, L, 2	P, –, NB	P, L, 1	M F
2275	Alco Rock West	M	P, U	P, U	P, –, NB	P, L, 2	M F
1833	Elkhorn	P, L, 2	M	P, L, 0	P, L, 0	M	- -
2011	Flat Creek	P, –, 0	P, L, 2	P, L, 0	P, L, 0	P, L, 0	- F
0885	Gobblers Knob	NR	P, U	P, L, 0	P, –, NB	P, U, 0	M F
1950	Lower Timber Creek	P, L, 0	P, –, NB	P, L, 0	P, L, 0	P, L, 0	M F
0898	Miller Mountain	M	M	P, L, 0	P, L, 0	P, L, 0	M -
0884	Shell Rock	NR	M	NR	P, L, 0	P, L, 2	M F
0954	Timbered Rock	P, U	P, U	NR	P, –, 1	P, –, NB	M F
2057	Upper Timber Creek	P, U	P, –, NB	P, L, 1	P, –, 2	P, NB	M F
2002	West Branch Elk	P, L, 1	M	P, L, 2	P, U	P, L, 1	M F
Active site with center on USFS and BLM							**Last year active**
1828	Hawk Creek	NR	NC	NC	P, L, 2	NC	M F 2001
Young on BLM within burn		3	3	5	5	6	Ave. 4.4 young
Inactive historic sites on BLM within the burn							**Last year active**
4029	Alco Ridge	NR	NR	NC	NC	NC	1994
2252	Flat Creek Divide	NR	NR	NC	NC	NC	1993
1829	Gobblers East	NC	NC	NC	NC	NC	1989
0056	Middle Creek	NR	NR	NR	NC	NC	1992
1825	Ragsdale	NR	NR	NR	NC	NR	1995
Inactive historic site on private timberland within the burn							**Last year active**
1954	East Jones Creek	NC	NC	NR	NC	NC	1991
Active site on BLM within watershed (LSR 224) but outside burn							
0879	Lost Creek	P, L, 1	P, –, NB	P, –, NB	P, U	P, U	M -
4028	Lower Morine Creek	P, L, 0	P, –, NB	P, L, 2	P, –, NB	P, L, 2	M F
1824	Morine Creek	P, L, 0	P, L, 2	P, –, NB	P, L, 2	P, L, 1	M F
1304	Oliver Springs	P, –, NB	P, –, NB	P, –, NB	P, –, NB	P, –, NB	M F
1959	Spot Creek	P, L, 1	P, –, NB	P, –, NB	NR P barred	NR P barred	- -
Young within BLM watershed		5	5	7	7	9	Ave. 6.6 young
Inactive historic site on BLM within watershed (LSR) but outside burn							**Last year active**
2218	Louis Creek	NR	NR	NC	NC	NR	Last in 1991
2006	South Boundary	NR	NR	NR	NR	NR	Last in 1995
Historic sites within watershed (LSR 224), outside burn, not on BLM							
3616	Hibbard Point (FS)	M, –, NB	P, –, NB	P, –, NB	M, –, NB	M, –, NB	M
0013	Alder Girl (FS)	P L 1	P –NB	P L 2	P L 1	P L 2	M F
3617	Button Creek	P L 0	P –NB	P L 1	P –NB	P L 0	M F
4468	Button Alder	NC	NC	NC	NC	NC	Last in 1993
4467	Bailey Butte	NC	NC	NC	NC	NC	Last in 1993

Legend

Adult Occupancy
- M Male only
- F Female only
- P Pair of adults
- NR No response
- NC Not checked

Breeding Status
- NB Not breeding
- U Unknown if breeding
- L Nest tree located
- 0 No young, failed
- 1 1 young observed
- 2 2 young observed

Table N-2. Acres of Suitable Spotted Owl Habitat by Active Site, Pre- and Post-fire, within a ¼-mile radius center of activity (125 acres) and a ½-mile radius (502 acres)

Master site #	Site Name	Pre-fire acres		Post-fire acres and % Reduction in Suitable				Probability of Reoccupancy (Subjective)
		¼-mile	½-mile	¼-mile		½-mile		
Active sites with center of activity on BLM								
2001	Alco Creek	18	27	0	-100%	0	-100%	0
2012	Alco Rock	103	282	63	-39%	142	-50%	60*
2275	Alco Rock West	90	278	79	-12%	232	-17%	60*
1833	Elkhorn	111	300	91	-18%	216	-28%	80*
2011	Flat Creek	102	216	101	-1%	204	-6%	80*
0885	Gobblers Knob	60	149	51	-15%	118	-21%	60*
1950	Lower Timber Creek	99	275	30	-70%	121	-66%	10*
0898	Miller Mountain	48	132	22	-54%	29	-78%	10
0884	Shell Rock	65	159	0	-100%	0	-100%	0
0954	Timbered Rock	125	489	19	-85%	212	-57%	60*
2057	Upper Timber Creek	99	288	67	-32%	174	-40%	80*
2002	West Branch Elk	110	256	92	-16	174	-12%	80*
Active site with center on USFS and BLM								
1828	Hawk Creek	125	490	75	-42%	290	-40%	80*
Inactive sites with center on BLM								
4029	Alco Ridge	40	40	40	-0%	40	-0%	0
2252	Flat Creek Divide	91	250	72	-21%	160	-36%	20
1829	Gobblers East	44	99	40	-9%	52	-47%	0
0056	Middle Creek	66	115	49	-26%	49	-57%	10
1825	Ragsdale	121	365	69	-43%	170	-53%	20
Inactive historic site on private timberland within the burn								
1954	East Jones Creek	10	90	0	-100%	0	-100%	0
Active site on BLM within watershed (LSR) but outside burn								
0879	Lost Creek	125	371		-0%		-0%	100
4028	Lower Morine Creek	125	480		-0%		-0%	100
1824	Morine	125	480		-0%		-0%	100
1304	Oliver Springs	92	213		-0%		-0%	90
1959	Spot Creek	120	480		-0%		-0%	60
Inactive site within watershed (LSR) but outside burn								
2218	Louis Creek	67	77		-0%		-0%	20
2006	South Boundary	69	183		-0%		-0%	20

NOTE: "Suitable" acres includes nesting, roosting, foraging (habitat 1 and 2) plus underburned (habitat 7 and 8) that will recover in 2 to 5 years. The far right column lists the subjective estimate of whether owls will continue to be present at the pre-fire center of activity, based on the amount of remaining suitable habitat, as well as previous occupancy and reproduction.
*Sites predicted to remain active post-fire.

Table N-3. 2003 Spotted Owl Survey Results

Master Site #	Site Name	#Day/ Night Visits	Pair Status	Presence, Color Banding		Breeding Status, Comments
				Male	Female	
Active sites pre and post burn with center of activity on BLM within the burn						
2001	Alco Creek	1/5	Pair	UB-new	CB-old	not breeding
2012	Alco Rock	5/2	Pair	CB-new	CB-new	nest tree, one young fledged
2275	Alco Rock West	1/3	Pair	CB-old	UN-unk	not breeding
1833	Elkhorn	2/6	Single	UB-unk	NR	unknown if breeding
2011	Flat Creek	6/1	Pair	CB-old	CB-old	not breeding
0885	Gobblers Knob	3/2	Pair	UB-new	CB-old	not breeding
0898	Miller Mountain	1/2	Pair	CB-old	CB-old	not breeding
0954	Timbered Rock	1/5	Single	CB-old	NR	unknown if breeding
2057	Upper Timber Creek	5/0	Pair	CB-old	CB-old	nest tree, one young died
2002	West Branch Elk	3/0	Pair	CB-old	CB-old	not breeding
Active site with center on USFS and BLM						
1828	Hawk Creek	4/0	Pair	Un-unk	CB-old	nest tree, fate undetermined
Sites active pre burn, but vacant post burn, on BLM						
1950	Lower Timber Creek	1/6	Vacant	NR	NR	old core burned hot
0884	Shell Rock	0/6	Vacant	NR	NR	old core burned hot
Inactive historic sites on BLM within the burn						
4029	Alco Ridge	0/6	Vacant	NR	NR	last active in 1994
2252	Flat Creek Divide	2/4	Vacant	NR	NR	last active in 1995
1829	Gobblers East	0/6	Vacant	NR	NR	last active in 1989
0056	Middle Creek	0/6	Vacant	NR	NR	last active in 1995
1825	Ragsdale	0/6	Vacant	NR	NR	last active in 1997
Inactive historic site on private timberland within the burn						
1954	East Jones Creek	0/6	Vacant	NR	NR	last active in 1991, logged in 2003
Active historic site on BLM within the watershed (LSR) but outside the burn						
0899	Lost Creek	3/0	Pair	CB-old	CB-old	not breeding
4028	Lower Morine Creek	2/0	Pair	CB-old	CB-old	not breeding
1824	Morine	3/1	Pair	CB-old	UB-new	not breeding
1304	Oliver Springs	2/0	Pair	CB-old	CB-old	not breeding
1959	Spot Creek	3/0	Vacant	NR	NR	barred owl pair present since 2001
Other sites on BLM within the watershed (LSR) but outside the burn						
2218	Louis Creek	4/2	Pair	CB-new	UB-new	nested, failed. last active in 1993
2006	South Boundary	1/5	Vacant	NR	NR	no response
4618	Hungry Elk	3/1	Pair	CB-new	CB-new	unknown if nesting, new site in 03

Legend: Male/Female: CB = Color Banded, UB = uUnbanded, Un = Unknown if banded, NR = no response.
Old = Bird was documented present in a previous year. New = New individual this year. Unk = Not seen to determine if the individual is color banded or if it is a new replacement bird.

Table N-4. Acres of Proposed Area Salvage by Alternative within ¼ and ½ mile of an Owl Activity Center

Site #	Site Name	Alternative											
		A and B		C		D		E		F		G	
		¼ mile	½ mile	¼ mile	½ mile	¼ mile	½ mile	¼ mile	½ mile	¼ mile	½ mile	¼ mile	½ mile
Post-fire active site within the fire on BLM													
2001	Alco Creek	0	0	0	0	0	0	5	5	0	5	0	6
2012	Alco Rock	0	0	0	0	0	2	40	110	0	7	0	34
2275	Alco Rock West	0	0	0	24	0	24	52	186	0	0	0	11
1833	Elkhorn	0	0	0	17	0	10	5	35	0	0	0	10
2011	Flat Creek	0	0	0	30	0	15	5	41	0	5	0	34
0885	Gobblers Knob	0	0	0	8	0	5	13	51	0	3	0	5
0898	Miller Mountain	0	0	0	19	0	19	4	26	0	6	0	21
0954	Timbered Rock	0	0	48	74	0	0	72	234	0	9	0	7
2057	Upper Timber Creek	0	0	0	9	0	6	8	90	0	14	0	32
2002	West Branch Elk	0	0	0	21	0	21	18	40	0	0	0	9
Active site with center on USFS and BLM													
1828	Hawk Creek	0	0	0	28	0	28	6	39	0	0	0	0
Pre-fire active site now vacant in 2003													
1950	Lower Timber Creek	0	0	42	49	39	40	63	130	4	6	17	42
0884	Shell Rock	0	0	0	102	49	103	49	103	0	0	0	2
Inactive historic sites on BLM within the fire													
4029	Alco Ridge	0	0	0	0	0	15	2	2	0	0	0	0
2252	Flat Creek Divide	0	0	1	20	15	41	47	125	2	7	15	41
1829	Gobblers East	0	0	0	0	0	21	0	24	0	9	0	23
0056	Middle Creek	0	0	0	8	0	9	10	57	10	16	3	35
1825	Ragsdale	0	0	18	23	22	37	54	162	0	14	31	56
Inactive historic site on private timber and within the fire													
1954	East Jones Creek	0	0	0	0	0	29	6	38	0	4	6	33
Acres at 11 active sites		0	0	0	211	0	130	222	857	0	49	0	169
Number of active sites within units		0	0	0	8	0	9	11	11	2	7	0	10
Acres at 8 vacant sites		0	0	110	202	125	205	231	641	26	56	72	232
Number of inactive sites within units		0	0	4	5	4	8	8	8	3	6	5	7
Acres outside ½-mile radii		0		822		485		1,771		108		278	
Area salvage acres		0		1,235 x.2		820		3,269		213		679	
Number of salvage units		0		179		125		584		134		83	

NOTE: Only Alternative G acres have been updated from the DEIS.

Table N-5. Acres of Proposed Roadside Hazard Removal by Alternative within ¼ and ½ mile of an Owl Activity Center

Site #	Site Name	Alternative											
		A and B		C		D		E		F		G	
		¼ mile	½ mile	¼ mile	½ mile	¼ mile	½ mile	¼ mile	½ mile	¼ mile	½ mile	¼ mile	½ mile
Post-fire active site within the fire on BLM													
2001	Alco Creek	0	0	0	1	0	1	0	1	5	1	0	15
2012	Alco Rock	0	0	0	63	0	63	0	0	0	59	0	64
2275	Alco Rock West	0	0	0	45	0	45	30	75	0	45	0	41
1833	Elkhorn	0	0	0	23	0	23	11	34	0	29	0	26
2011	Flat Creek	0	0	0	22	0	29	29	51	0	33	0	20
0885	Gobblers Knob	0	0	3	29	0	28	3	29	0	29	0	35
0898	Miller Mountain	0	0	11	40	11	40	11	39	11	41	0	28
0954	Timbered Rock	0	0	0	0	0	0	0	0	0	0	0	0
2057	Upper Timber Creek	0	0	0	42	0	43	16	58	0	40	0	51
2002	West Branch Elk	0	0	0	21	0	21	0	0	0	0	0	0
Active site with center on USFS & BLM													
1828	Hawk Creek	0	0	0	28	0	0	0	0	0	0	0	10
Pre-fire active site now vacant in 2003													
1950	Lower Timber Creek	0	0	5	45	5	40	5	45	6	47	2	26
0884	Shell Rock	0	0	0	2	0	2	0	6	11	37	0	6
Inactive historic sites on BLM within the fire													
4029	Alco Ridge	0	0	15	15	15	15	15	15	15	15	15	15
2252	Flat Creek Divide	0	0	4	19	0	9	4	19	4	23	0	14
1829	Gobblers East	0	0	5	30	5	25	5	30	5	30	5	27
0056	Middle Creek	0	0	3	9	3	9	3	12	3	10	7	10
1825	Ragsdale	0	0	10	25	9	22	10	25	10	22	4	12
Inactive historic site on private timberland within the fire													
1954	East Jones Creek	0	0	0	1	0	0	0	1	0	1	0	0
Acres at 11 active sites		0	0	14	314	11	293	100	287	16	277	0	290
Number of active sites within units		0	0	2	10	1	9	6	7	2	8	0	9
Acres at 8 vacant sites		0	0	42	146	37	122	42	153	54	185	33	110
Number of inactive sites within units		0	0	6	8	5	7	6	8	7	8	5	7
Hazard acres outside ½ mile		0		618		763		96		720		788	
Total Road Hazard Acres		**0**		**1,078**		**1,088**		**536**		**1,182**		**1,188**	
NOTE: Only Alternative G acres have been updated from the DEIS.													

Table N-6. Acres in Ridgeline FMZs by Alternative within ¼ and ½ mile of an Owl Activity Center

Master Site #	Site Name	Alternative											
		B		C		D		E		F		G	
		¼ mile	½ mile	¼ mile	½ mile	¼ mile	½ mile	¼ mile	½ mile	¼ mile	½ mile	¼ mile	½ mile
Post-fire active sites with center of activity on BLM within the fire													
2012 *	Alco Rock	0	25	0	25	0	25	0	25	0	25	0	25
0885 *	Gobblers Knob	0	17	0	17	0	17	0	17	0	17	0	17
0954 *	Timbered Rock	4	42	4	42	4	42	4	42	4	42	4	42
2057 *	Upper Timber Creek	0	27	0	27	0	27	0	27	0	27	0	27
Historically active site, but vacant post-fire, on BLM within the fire													
1950	Lower Timber Creek	0	29	0	29	0	29	0	29	0	29	8	29
Inactive historic sites on BLM within the fire													
1829	Gobblers East	0	55	0	55	0	55	0	55	0	55	0	55
0056	Middle Creek	8	17	8	17	8	17	8	17	8	17	8	17
1825	Ragsdale	0	3	0	3	0	3	0	3	0	3	0	3
Historic sites within watershed but outside the fire													
1959 *	Spot Creek	6	22	6	22	6	22	6	22	6	22	6	22
2006	South Boundary	6	67	6	67	6	67	6	67	6	67	6	67
Historic sites outside the watershed, adjacent to FMZ													
2625 *	Toothacher	0	30	0	30	0	30	0	30	0	0	0	27
1823	Trailhead	0	18	0	18	0	18	0	18	0	0	0	18
Acres at 6 active sites		10	163	10	163	10	163	10	163	10	133	10	160
Acres at 6 vacant sites		14	189	14	189	14	189	14	189	14	171	14	189
FMZ acres outside ½ mile radii		948		948		948		948		246		951	
Total FMZ Acres		**1,300**		**1,300**		**1,300**		**1,300**		**550**		**1,300**	

NOTE: *Active sites in 2003, post-burn.
Only the acres for Alternative G have been updated since the DEIS.

Table N-7. Acres of Proposed Young Stand (10-30 years) Thinning by Alternative within ¼ and ½ mile of an Owl Activity Center

Master Site #	Site Name	Alternative											
		B		C		D		E		F		G	
		¼ mile	½ mile	¼ mile	½ mile	¼ mile	½ mile	¼ mile	½ mile	¼ mile	½ mile	¼ mile	½ mile
Active sites with center of activity on BLM within the fire													
2275 *	Alco Rock West	0	4	0	4	0	4	0	4	0	0	0	7
0885 *	Gobblers Knob											0	4
2011 *	Flat Creek											0	1
Sites vacant in 2003 with center of activity on BLM within the fire													
1950	Lower Timber Creek	0	5	0	0	0	0	0	5	0	0	0	2
1829	Gobblers East											3	3
Sites within the watershed but outside the fire													
4618 *	Hungry Elk											0	9
1304 *	Oliver Springs	8	50	4	28	4	28	8	50	0	0	8	28
2218 *	Louis Creek	29	61	19	48	19	48	29	61	0	0	29	48
4028 *	Lower Morine											0	3
2006	South Boundary	9	72	9	72	9	72	9	72	0	0	9	72
1823	Trailhead											0	9
Thin acres at 7 active sites		37	115	23	80	23	80	37	115	0	0	37	100
Thin acres at 4 vacant sites		9	77	9	72	9	72	9	77	0	0	12	86
Thin acres outside ½ mile radii		752		635		635		752		0		676	
Total Young Thin Acres		**1,028**		**862**		**862**		**1,028**		**0**		**862**	

NOTE: *Active sites post-fire.
Only the acres for Alternative G have been updated since the DEIS.

Table N-8. Acres of Proposed Old Stand (30-80 years) Thinning by Alternative within ¼ and ½ mile of an Owl Activity Center

Master Site #	Site Name	Alternative											
		B		C		D		E		F		G	
		¼ mile	½ mile	¼ mile	½ mile	¼ mile	½ mile	¼ mile	½ mile	¼ mile	½ mile	¼ mile	½ mile
Post-fire active sites with center of activity on BLM within the fire													
2275 *	Alco Rock West	0	0	8	21	8	21	11	32	0	0	8	21
1833 *	Elkhorn	0	0	0	0	0	0	0	7	0	0	0	7
2011 *	Flat Creek	0	0	0	1	0	1	0	1	0	0	0	1
0885 *	Gobblers Knob	0	0	3	5	3	5	3	21	0	0	0	20
2057 *	Upper Timber Creek	0	0	0	0	0	0	0	2	0	0	0	1
Inactive sites on BLM within the fire													
2252	Flat Creek Divide	0	0	2	22	2	22	2	22	0	0	2	18
1829	Gobblers East	0	0	5	5	5	5	5	11	0	0	0	5
1950	Lower Timber	0	0	5	25	5	25	5	27	0	0	2	21
Historic sites within the watershed but outside the fire													
4618 *	Hungry Elk											0	13
4028 *	Lower Morine	0	0	0	11	0	11	0	11	0	0	0	7
1304 *	Oliver Springs	0	0	0	9	0	9	0	16	0	0	0	7
1959 *	Spot Creek	0	0	0	13	0	13	0	14	0	0	0	14
2006	South Boundary	0	0	0	10	0	10	0	10	0	0	0	11
Thin acres at 9 active sites		0	0	11	60	11	60	14	104	0	0	8	91
Thin acres at 4 vacant sites		0	0	12	62	12	62	12	70	0	0	4	55
Thin acres outside ½ mile radii		0		542		542		964		0		320	
Total Old Thin Acres		**0**		**466**		**466**		**820**		**0**		**466**	

NOTE: *Active sites post-fire.
Only the Alternative G acres have been updated since the DEIS.

Table N-9. Acres of Proposed Riparian Thinning by Alternative within ¼ and ½ mile of an Owl Activity Center

Master Site #	Site Name	Alternative											
		B		C		D		E		F		G	
		¼ mile	½ mile	¼ mile	½ mile	¼ mile	½ mile	¼ mile	½ mile	¼ mile	½ mile	¼ mile	½ mile
Active sites with center of activity on BLM within the fire													
2275 *	Alco Rock West	0	2	11	23	0	2	11	24	0	0	11	23
1833 *	Elkhorn	0	0	0	0	0	0	0	3	0	0	0	0
0885 *	Gobblers Knob	0	0	0	0	0	0	5	18	0	0	0	0
2057 *	Upper Timber Creek	0	0	0	0	0	0	0	8	0	0	0	0
Inactive sites on BLM within the fire													
2252	Flat Creek Divide	0	0	0	0	0	0	0	9	0	0	0	0
1829	Gobblers East	0	0	0	0	0	0	0	15	0	0	8	8
1950	Lower Timber	0	0	9	51	0	0	12	62	0	0	9	51
Sites within the watershed but outside the fire													
4618 *	Hungry Elk											0	9
4028 *	Lower Morine	0	0	0	6	0	0	0	6	0	0	0	4
1304 *	Oliver Springs	0	0	0	0	0	0	0	20	0	0	0	0
2218 *	Louis Creek	0	3	0	3	0	3	8	19	0	0	0	12
2006	South Boundary	1	19	1	19	1	19	11	69	0	0	1	18
Thin acres at active sites		0	5	11	32	0	5	24	170	0	0	11	48
Thin acres at inactive sites		1	19	10	70	1	19	23	155	0	0	18	77
Thin acres outside ½ mile radii		93		245		323		725		0		234	
Total Riparian Thin Acres		**309**		**359**		**359**		**939**		**0**		**359**	

NOTE: *Active sites post-fire.
Only Alternative G acres have been updated since the DEIS.

Table N-10. Acres of Research Units within ¼ and ½ mile of an Owl Activity Center

Site #	Site Name	Moderate Salvage		Heavy Salvage	
		¼ mile	½ mile	¼ mile	½ mile
Sites active post-fire					
2012	Alco Rock			22	32
2275	Alco Rock West	6	37		
1828	Hawk Creek				27
0954	Timbered Rock	21	42		
Sites vacant post-fire					
1950	Lower Timber Creek	46	53		
0884	Shell Rock	19	53	35	56
Total Acres		**92**	**185**	**57**	**115**
Acres of units outside ½ mile		**6**		**32**	

NOTE: Not all acres of designated units will be harvested.

Table N-11. Timbered Rock 2003 Special Status Species Review Special Status Species in the Butte Falls Resource Area

Species	Status	Range	Presence	Comments
Bald eagle	FT	Yes	Present	Forage in watershed. No known nest site. Two active nests in adjacent watersheds.
Black-backed woodpecker	BS	Yes	Absent	No record of presence in watershed. No known sightings in area. Habitat is primarily lodgepole, ponderosa, and mixed conifer forests. Could be attracted to burned timber.
Cascades frog	BS	Yes	Present	Records of presence in one pond. Surveys in 2003 were negative. Pond was dug out for fire, may not be suitable.
Common kingsnake	BA	Yes	Present	No record of presence in watershed. Habitat is present along Elk Creek.
Crater Lake tightcoil	BS, SM	Unknown	Uncertain	No record of presence in watershed. Only record in southern Oregon is in high elevation spring at Crater Lake.
Fisher	BS	Yes	Present	Located in Bitter Lick Creek drainage on USFS lands. Likely present on BLM.
Foothill yellow-legged frog	BA	Yes	Present	Present in Elk Creek
Fringed myotis	BA	Yes	Uncertain	No records of presence in watershed. One pond mist net survey was done in 2003.
Gray wolf	FE Extirpated	No	Absent	Unconfirmed sightings have occurred in southern Oregon. None have been determined to be wild wolf. Wolf are considered extirpated in Oregon
Great gray owl	SM	Yes	Present	Presence confirmed in Morine Creek. Suitable habitat in watershed. Surveys in 2003 were negative.
Lewis' woodpecker	BS	No	Uncertain	At edge of range. No record of presence in watershed. Could be present in lower elevations.
Mardon skipper butterfly	FC	U	Uncertain	No record of presence in watershed. Wet mountain meadow habitat. Nearest known site is near Greensprings. Low probability of presence.
Northern goshawk	BS	Yes	Present	Incidental sighting in watershed. Present in adjacent watershed. Likely present.
Northern spotted owl	FT	Yes	Present	Nests in watershed.
Oregon megomphix (snail)	SM	Yes	Uncertain	No surveys. Not found in surveys in adjacent watersheds to east and west.
Oregon shoulderband (snail)	BS	Yes	Suspected	No surveys. Habitat is present. Found in adjacent watershed around Lost Creek in grasslands and oak woodlands/mixed conifer adjacent to woodlands.
Peregrine falcon	BS	Yes	Present	One known nest in watershed. Suitable cliffs are present. Nest cliffs in fire boundary were surveyed with negative results in 2003.
Red tree vole	SM	Yes	Present	Surveys in 2003 confirmed active nests in the watershed in green stands.
Tailed frog	BA	Yes	Uncertain	No record of presence in watershed. Usually present in cold, headwater streams.
Three-toed woodpecker	BS	No	Absent	Outside range, but could be drawn to fire-killed snags.
Townsend's big-eared bat	BS	Yes	Present	Present in cave near mouth of Elk Creek. Limited surveys of caves in watershed.
Tricolored blackbird	BA	No	Absent	Outside range. Found near Medford at Denman Wildlife Refuge ponds.

Table N-11. Timbered Rock 2003 Special Status Species Review Special Status Species in the Butte Falls Resource Area

Species	Status	Range	Presence	Comments
Vernal pool fairy shrimp	FT	No	Absent	No suitable vernal pools in Elk Creek Watershed.
Western pond turtle	BS	Yes	Present	Present in one pond on private land. No turtles observed in BLM ponds. Ponds surveyed in 2002 and 2003.
White-headed woodpecker	BS	No	Absent	Occasional visitor to Dead Indian Plateau. May be drawn to dead trees.
Wolverine	ST	No	Absent	Reported sightings in upper elevation USFS lands in wilderness areas. Snow track surveys by BLM and USFS were negative.

Status:
FE - USFW Endangered: in danger of extinction throughout a significant portion of its range
FT - USFW Threatened: likely to become endangered species within the foreseeable future
FC - USFW Candidate: proposed and being reviewed for listing as threatened or endangered
ST - State Threatened: listed as likely to become endangered by the state of Oregon
SM - Survey & Manage: NFP ROD directs protection of known sites and/or survey for new sites
BS - Bureau Sensitive (BLM): eligible for addition to Federal Notice of Review, and known in advance of official publication. Generally these species are restricted in range and have natural or human-caused threats to their survival.
BA - Bureau Assessment Species (BLM): not presently eligible for official federal or state status, but of concern. May at a minimum need protection or mitigation in BLM activities.

Special Status Wildlife Species-2003 Habitat and Occurrence in the Butte Falls Resource Area

Bald eagle (*Haliaeetus leucocephalus*)

Five nesting pairs are known within the BFRA; two nests are on BLM lands and three are on private lands. In Oregon, the majority of nests (84%) are located within one mile of lakes, reservoirs, large rivers, and coast estuaries. Nest trees are larger, dominant or co-dominant trees in the stand and are usually components of old growth or older second growth forests. Prey is fish, waterfowl, small mammals (rabbits, etc.), and carrion.

Black-backed woodpecker (*Picoides arcticus*)

Presence is undetermined in the BFRA. Has been documented in Cascade Mountains in Jackson County and in the Siskiyou Mountains in Josephine County. In Oregon, the black-backed woodpecker tends to occur in lower elevation forests of lodgepole pine, ponderosa pine, or mixed pine/conifer forests. Dead trees used for foraging have generally been dead three years or less.

Cascades frog (*Rana cascade*)

Found in the Cascade Mountains, above 2600', on the east side of the District. They are most commonly found in small pools adjacent to streams flowing through meadows. They are also found in small lakes, bogs, and marshy areas that remain damp thorough the summer.

Common kingsnake (*Lampropeltis getulus*)

In Oregon, they are found only in Douglas, Jackson, and Josephine counties in the more mesic river valleys. Common kingsnake inhabit oak/pine woodlands, open brushy areas, and river valleys, often along streams and in thick vegetation. They may also be found in farmlands, especially near water areas. Have been observed in Sam's Valley.

Crater Lake tightcoil (*Pristiloma arcticum crateris*)

Species is known from south of Crater Lake, Klamath County, and an occurrence in Jefferson County. Species may be found in moist conifer forests and among mosses and other vegetation near wet lands, springs, seeps, and riparian areas above 2000' elevation.

Fisher (*Martes pennanti pacifica*)

Habitat is mature and old growth forests. They appear to be closely associated with riparian areas in these forests. They seem to prefer 40-70% canopy cover. They mainly use large living trees, snags and fallen logs for denning. USFS study near Prospect was completed in 2002. Fisher have been detected in Bitter Lick Creek drainage on USFS and in the Red Rock Canyon and Titanic Creek areas on BLM land. Little information is available as to distribution and density.

Foothill yellow-legged frog (*Rana boylii*)
Habitat is permanent streams with rocky, gravelly bottoms. Distribution is west of the Cascade crest from sea level to 1800'. These frogs are closely associated with water.

Fringed myotis bat (*Myotis thysanodes*)
Fringed myotis is a crevice dweller which may be found in caves, mines, buildings, rock crevices, and large old growth trees. They have been captured in openings and in mid-seral stage forest habitats. Food consists of beetles, butterflies, and moths.

Great gray owl (*Strix nebulosa*)
Habitat preference is open forest or forest with adjoining deep-soil meadows. Nest in broken top trees, abandoned raptor nests, mistletoe clumps, and other platforms created by whorls of branches. Majority of nests in one study were in over-mature or remnant stands of Douglas fir and grand fir forest types on north facing slopes. Probably found in low densities across the district.

Lewis' woodpecker (*Melanerpes lewis*)
These woodpeckers breed sparingly in the foothill areas of the Rogue and Umpqua river valleys in Douglas, Jackson, and Josephine counties. Habitat preference is hardwood oak stands with scattered pine near grassland shrub communities. Breeding areas in the Rogue valley are uncertain. In some locales, the woodpeckers breed in riparian areas having large cottonwoods and in oak conifer woodlands. They usually do not excavate nest cavities, but most often use cavities excavated by other woodpecker species. They winter in low elevation oak woodlands.

Mardon skipper butterfly (*Polites mardon*)
Only known in four localities, two in Washington state, one in Del Norte County coastal mountains, and the fourth in high mountain meadows along the summit of the Cascade Mountains in Jackson and Klamath Counties. They are found in wet mountain meadow habitats.

Northern goshawk (*Accipiter gentilis*)
Goshawks are found in a variety of mature forest types, including both deciduous and conifer types. Dense overhead foliage or high canopy cover is typical of nesting goshawk habitat. Perches where they pluck their prey, known as plucking posts, are provided by stumps, rocks, or large horizontal limbs below the canopy.

Northern spotted owl (*Strix occidentalis caurina*)
Old growth coniferous forest is preferred nesting, roosting, and foraging habitat, or areas with some old growth characteristics with multi-layered, closed canopies with large diameter trees with an abundance of dead and down woody material. Northern spotted owls commonly nest in cavities 50' or more above the ground in large decadent old growth trees. Other nest sites include large mistletoe clumps, abandoned raptor nests, and platforms formed by whorls of large branches. Over 200 northern spotted owl "core areas", 100 acres of the best habitat around activity centers for known sites (as of 1/1/94) have been designated and mapped as Late-Successional Reserves. Prey is primarily small arboreal mammals, such as flying squirrels, woodrats, voles, etc. and occasionally small birds.

Oregon Megomphix (*Megomphix hemphilli*)
Expected to occur in moist conifer/hardwood forests up to 3000'. Found in hardwood leaf litter and decaying non-coniferous plant matter under bigleaf maple trees, especially if there are any rotten logs or stumps nearby. A bigleaf maple component in the tree canopy and an abundance of sword fern on forested slopes and terraces seems characteristic of the sites.

Oregon shoulderband (*Helminthoglypta hertleini*)
This species is known from rocky areas including talus deposits, but not necessarily restricted to these areas. Suspected to be found within its range wherever permanent ground cover and/or moisture is available. This may include rock fissures or large woody debris sites. Somewhat adapted to fairly xeric conditions during a part of the year.

Peregrine falcon (*Falco peregrinus*)
Primary habitat is tall cliffs. Three confirmed sites occur in the BFRA. Occasional sightings are made during the winter months, but these are thought to be migrating individuals. Forest lands provide habitat for prey species for peregrine falcons. Prey is mostly birds, especially doves and pigeons. Peregrines also prey on shorebirds, waterfowl, and passerine birds.

Red tree vole (*Arborimus longicadus*)
An arboreal vole which lives in Douglas fir, spruce, and hemlock forests. Food consists entirely of needles of the tree in which they are living. They build a bulky nest, up to a half bushel, in the branches usually near the trunk, 15-100' above the ground. The nest becomes larger with age, and may be occupied by many generations.

Tailed frog (*Ascaphus truei*)

Habitat is cold, fast flowing permanent streams in forested areas. Temperature tolerance range is low, 41-61° Fahrenheit. Tailed frog are closely tied to water.

Three-toed woodpecker (*Picoides tridactylus*)

Presence is undetermined in the Medford BLM District. Range is along the crest of the Cascade Range and eastward. Generally found in higher elevation forests, above 4000'. In eastern Oregon, three-toed woodpeckers nest and forage in lodgepole pine forests. They are occasionally found roosting in hemlock and Engelmann spruce trees in mature and over mature mixed conifer forests. Bark beetle larvae are primary food source.

Townsend's big-eared bat (*Corynorhinus townsendii*)

Roost in mines, caves, cavities in trees, and attics of buildings. They have low tolerance to changes in temperature and humidity and removal of trees around these sites may change airflow patterns to make the area less desirable as a hibernaculum, maternity, or roosting site. Food consists primarily of moths, and other arthropods.

Tricolored blackbird (*Agelaius tricolor*)

Tricolored blackbirds are found in the interior valleys of southern Oregon, near freshwater marshes and crop lands. Individuals have been reported near Roxy Ann Peak, in Sams Valley, and near Table Rock.

Vernal Pool Fairy Shrimp (*Branchinecta lynchi*)

Habitat is vernal pools. They have only been found in Agate Desert and Table Rock areas.

Western pond turtle (*Clemmys marmorata marmorata*)

Live in most types of freshwater environments with abundant aquatic vegetation, basking spots, and terrestrial surroundings for nesting and over-wintering. Some northwestern pond turtles leave water in late October to mid-November to overwinter on land. They may travel up to ¼ mile from water, bury themselves in duff and remain dormant throughout winter. Turtles have been found to generally stay in one place in areas with heavy snow pack, but may move up to 5-6 times in a winter in areas with little or no snow. General habitat characteristics of over wintering areas appear to be broad. There may be specific microhabitat requirements, which are poorly understood at this time.

In many areas, predation on the hatchlings and competition from bullfrogs, bass, and other exotic species is limiting population levels. Adult turtles are relatively long lived, but as the adults age, recruitment is not occurring at levels which can maintain future healthy populations.

White-headed woodpecker (*Picoides albolarvatus*)

Presence in the BLM Medford District is undetermined. White-headed woodpeckers occur in ponderosa pine and mixed ponderosa forests. They forage mainly on trunks of living conifers for insects. Nest cavities are within 15 feet of ground in dead trees which have heart rot. Standing and leaning snags and stumps are used. Area is in periphery of known range.

Table N-12. Primary Cavity Excavators in Elk Creek

Chestnut-backed chickadee
Downy woodpecker
Hairy woodpecker
Northern flicker
Pileated woodpecker
Red-breasted nuthatch
Red-breasted sapsucker
Black bear

Table N-13. Bird Survey Synopsis: Buck Rock Bird Route

Species	1995 Survey Presence	1996 Survey Presence	1997 Survey Presence	2003 Survey Presence
American robin (AMRO)	X	X	X	X
Band-tailed pigeon (BTPI)				X
Black-capped chickadee (BCCH)				X
Black throated gray warbler (BTGW)		X		X
Black-headed grosbeak (BHGR)	X	X	X	X
Brown creeper (BRCR)				X
Brown-headed cowbird (BHCO)				X
Bushtit (BUSH)		X	X	
Canada goose (CAGO)	X			X
Cassin's vireo (CAVI) (SOVI-old)	X	X	X	X
Chestnut-backed chickadee (CBCH)	X	X	X	X
Common raven (CORA)		X		X
Dark-eyed junco (DEJU)	X	X	X	X
Downy woodpecker (DOWO)			X	
Gold-crowned kinglet (GCKI)	X	X		X
Hairy woodpecker (HAWO)		X	X	X
Hermit thrush (HETH)	X	X	X	X
Hermit warbler (HEWA)	X	X	X	X
House Wren (HOWR)	X	X	X	X
Huttons vireo (HUVI)				X
Lazuli bunting (LEBU)	X	X	X	X
Lesser goldfinch (LEGO)				X
McGillavry's warbler (MGWA)	X	X	X	X
Mountain quail (MOQU)	X	X	X	X
Mourning dove (MODO)				X
Nashville warbler (NAWA)	X	X	X	X
Northern Flicker (NOFL)		X	X	X
Olive-sided flycatcher (OSFL)	X		X	X
Orange-crowned warbler (OCWA)	X	X	X	X
Pacific-slope flycatcher (PSFL)		X	X	X
Pileated woodpecker (PIWO)	X	X	X	X
Pine siskin (PISI)	X	X		X
Purple finch (PUFI)	X	X	X	X
Red-breasted nuthatch (RBNU)	X	X	X	X
Red-breasted sapsucker (RBSA)		X		X
Red Crossbill (RECR)			X?	X
Red-tailed hawk (RTHA)	X	X		X
Ruby-crowned kinglet (RCKI)				X
Ruffed grouse (RUGR)				X
Rufous hummingbird (RUHU)	X	X	X	X
Spotted towhee (SPTO)	X	X	X	X
Stellars Jay (STJA)	X	X	X	X
Townsend's solitaire (TOSO)	X			X
Townsend's warbler (TOWA)/(HETA)	X	X	X	X

Table N-13. Bird Survey Synopsis: Buck Rock Bird Route

Species	1995 Survey Presence	1996 Survey Presence	1997 Survey Presence	2003 Survey Presence
Turkey vulture (TUVU)				X
UNK hummingbird (HUMM)	X	X	X	X
UNK woodpecker (WOOD)		X		
Warbling vireo (WAVI)		X		X
Western Flycatcher (WEFL)	X			
Western tanager (WETA)	X	X	X	X
Western wood peewee (WWPE)	X		X	X
White-crowned sparrow (WCSP)				X
Wild turkey				X
Wilson's warbler (WIWA)	X	X	X	X
Yellow-rumped warbler (YRWA)	X	X	X	X

Table N-14. 2003 Goshawk Surveys in Elk Creek Watershed

Location	Date	Response	Date	Response
T32S-R1W-01	07-15-03	No Response	07-31-03	No Response
T32S-R1W-31	07-10-03	Sharp-shinned response*		
T32S-R1W-25	07-10-03	No Response	07-28-03	No Response
T32S-R1E-05	07-14-03	No Response	07-28-03	No Response
T32S-R1E-17	07-14-03	No Response		
T32S-R1E-10	07-17-03	No Response	07-28-03	No Response

NOTE: *Located on private land adjacent to BLM

Table N-15. 2003 Great Gray Owl Surveys in Elk Creek Watershed

Location	Date	Response	Date	Response	Date	Response
T32S-R1E-11	03-26-03	No Response	05-06-03	No Response	05-27-03	No Response
T32S-R1E-23	03-31-03	No Response	05-27-03	No Response	06-24-03	No Response
T33S-R1E-09	03-31-03	No Response	05-27-03	No Response	06-24-03	No Response
T32S-R2E-32	04-29-03	No Response	05-21-02	*	06-04-03	No Response
T32S-R2E-32	03-27-03	No Response	04-30-03	No Response	05-13-03	No Response
T33S-R2E-05	03-27-03	No Response	04-30-03**	No Response	05-21-03	No Response
T33S-R1E-03	03-26-03	No Response	05-21-03	No Response		

NOTE: *Visual unknown owl; nothing located on follow-up.
**Great horned owl

Table N-16. Bat Species detected within the Elk Creek Watershed Alco Rock Pond Survey (10/01/03)

Long-eared myotis	1 male
Long-legged myotis	1 male
Silver haired bat	3 male 1 female

Table N-17. Elk Creek Pump Chance Survey - Post-Fire (2002 & 2003)

Pond	Date Checked	Animals Observed
Buck Rock (Private)	28 Sept 2002	No herps. Water level low, about 1/3 full
Ragged Rock	28 Sept 2002	No herps. Water clear. Gravel is deposited on uphill side. Needs cleaned out.
	18 July 2003	No herps. Water clear. Pool is full.
Alco Rock #1 (west)	11 Oct 2002	No herps seen. Helipond is nearly dry. No herps seen. Water muddy, newly cleared out for fire suppression activities
	03 May 2003	Checked for eggs/none observed.
	22 May 2003	2 rough skinned newts.
	18 July 2003	No herps seen. Visibility poor, water muddy.
Alco Rock #2 (east)	11 Oct 2002	No herps seen. Was cleaned out for fire suppression. Water is covered with duckweed. Outlet needs work, high water will flow around culvert.
	03 May 2002	No herps seen.
	22 May 2002	No herps seen. No eggs. Lot in insect larvae & water striders.
	18 July 2003	No herps seen.
Alco Rock #3	11 Oct 2002	No herps seen. Surface is covered with duckweed. Pond is surrounded by trees. Visibility poor. Deer sign. Pine squirrel in tree by water.
	18 July 2003	No herps seen. Visibility poor, pond covered with duckweed.
Wild lily	11 Oct 2002	No herps seen. Mostly filled with rock from high water.
	18 July 2003	No herps. Observed 6” trout. Good visibility
Timbered Rock	16 Oct 2002	No herps seen. Some brushing had occurred around pool for use as water source for fire.
	18 July 2003	No herps. Lot of water striders.
Morine Creek	28 Sept 2002	Could not find.
Alco Pond (private)	11 Oct 2002	Two adult western pond turtles basking on bank. Cattle had grazed around pond. Timbered Rock Fire had burned through area. Pond in good condition.
	18 July 2002	Logging activities closed roads. No access.

ROGUE RIVER/SOUTH COAST

BIOLOGICAL ASSESSMENT

FY 04 – 08
for
Activities that may affect listed species in the Rogue River/South Coast Province

for
MEDFORD DISTRICT,
Bureau of Land Management,
ROGUE RIVER and
SISKIYOU
National Forests

11 July 2003

BIOLOGICAL OPINION
(FWS)
1-14-03-F-511
20 October 2003

(Terms and Conditions [PDCs] – Appendix A)

United States Department of Agriculture, Forest Service	Siskiyou National Forest Rogue River National Forest	United States Department of Interior Bureau of Land Management Medford District

Reply To: 2670 (FS), 6840 (BLM) Date: July 14, 2003

Subject: Biological Assessment for FY04-08 Programmatic Consultation (Med BLM, ROR & SIS NFs)

To: Craig Tuss
Attn: David Clayton
USDI Fish and Wildlife Service
Roseburg Field Office
2900 NW Stewart Parkway
Roseburg, Oregon 97470

This letter and the enclosed Biological Assessment (BA) constitute a request for formal consultation with the USDI Fish and Wildlife Service (FWS) and meets our responsibilities on interagency cooperation (50 CFR 402) under Section 7 of the Endangered Species Act of 1973 (as amended) (Act). The enclosed Biological Assessment analyzes the effects to endangered and threatened species from activities by the Rogue River and Siskiyou National Forests, and the Medford District of the Bureau of Land Management, during Fiscal Years (FY) 04-08.

Species and habitats addressed include the threatened bald eagle (*Haliaeetus leucocephalus*), northern spotted owl (*Strix occidentalis caurina*), marbled murrelet (*Brachyramphus marmoratus*), vernal pool fairy shrimp (*Branchinecta lynchi*), and the endangered Cook's lomatium (*Lomatium cookii*), Gentner's fritillary (*Fritillaria gentneri*), large-flowered woolly meadowfoam *(Limnanthes floccosa* ssp. *grandiflora*), and McDonald's rockcress (*Arabis mcdonaldiana*), as well as effects to designated critical habitat for the spotted owl and marbled murrelet, and proposed critical habitat for the fairy shrimp. Listed and proposed anadromous fish species are not included in this BA. Programmatic consultation regarding these species occurs separately with the NOAA Fisheries.

We anticipate likely affects to listed species, related to both habitat modification and disturbance. Effects determinations are shown in Table 1. Effects of the FY04-08 projects on listed species vary; some projects are **MAY AFFECT LIKELY TO ADVERSELY AFFECT (LAA)** spotted owls, spotted owl critical habitat, and marbled murrelets, while other projects are **MAY AFFECT NOT LIKELY TO ADVERSELY AFFECT (NLAA)** for bald eagle, spotted owls, spotted owl critical habitat, marbled murrelets, marbled murrelet critical habitat, Cook's lomatium, and Gentner's fritillary and proposed critical habitat for fairy shrimp.

Table 1. Species Determinations by Activity Type. Where LAA is shown, No Effect, Not Likely to Adversely Affect, and Beneficial Effect determinations are also implied. MA = May Affect; CHU=Critical Habitat Unit; PCHU=Proposed Critical Habitat Unit

Activity Type	Spotted Owl	Spotted Owl CHU	Marbled Murrelet	Marbled Murrelet CHU	Bald Eagle	Fairy Shrimp	Fairy Shrimp PCHU	Cook's Lomatium	Gentner's Fritillary	Large-flowered Woolly Meadowfoam	McDonald's Rockcress
Tree Harvest	LAA	MA	LAA	MA	NLAA	NE	NE	NE	NLAA	NE	NE
Vegetation Management	LAA	MA	LAA	MA	NLAA	NE	NE	NLAA	NLAA	NE	NE
Watershed Restoration	LAA	MA	LAA	MA	NLAA	NLAA	MA	NLAA	NLAA	NLAA	NLAA
Recreation	LAA	MA	LAA	MA	NLAA	LAA	MA	NLAA	NLAA	NLAA	NLAA
Fuels Management	NLAA	MA	NLAA	MA	NLAA	NE	NE	NLAA	NLAA	NE	NLAA
Grazing	NE	NE	NE	NE	NE	NLAA	MA	NE	NLAA	NE	NE
Special Forest Products	NLAA	MA	NLAA	NE	NE	NE	NE	NE	NLAA	NE	NE
Road Maintenance /Construction	LAA	MA	LAA	MA	NLAA	NE	NE	NLAA	NLAA	NLAA	NLAA
Road Use Permits	LAA	MA	LAA	MA	NLAA	NE	NE	NE	NE	NE	NE
Other Special Use Permits	NLAA	MA	NLAA	MA	NLAA	NE	NE	NLAA	NLAA	NLAA	NLAA
Mining And Quarry Operation	LAA	MA	LAA	MA	NLAA	NE	NE	NLAA	NLAA	NE	NLAA
Cultural	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Weed Control	NE	NE	NE	NE	NE	NE	NE	NLAA	NLAA	NLAA	NLAA

We request formal consultation on **Likely to Adversely Effect** determinations and concurrence on **Not Likely to Adversely Effect** determinations. All determinations of effects are made with mandatory Project Design Criterion (PDCs) (conservation measures), fully implemented as noted in the BA.

If you have any questions, please call Lee Webb (541-471-6536) or Carole Jorgensen (541-618-2320) for wildlife issues and Mark Mousseaux (541-618-2232) or Maria Ulloa (541-471-6528) for plant issues. We appreciate the work and comments of David Clayton and Sam Friedman during this consultation. As always, we look forward to further work with you to conserve endangered and threatened species and the habitats upon which they depend.

/s/ *Scott D. Conroy* /s/ *Mary Smelcer*

SCOTT D. CONROY
Forest Supervisor
Rogue River and Siskiyou National Forests

MARY SMELCER
Acting District Manager, Medford Dist.
Bureau of Land Management

cc: Resource Area Managers, Medford District BLM
Rogue River Siskiyou NFs District Rangers

Attachment: FY 2004-2008 Programmatic Biological Assessment

Excerpts from USFWS Biological Opinion, #1-14-03-F-511, dated 20 October 2003.

This appendix section records quotes from the recently released BA/BO consultation package involving BLM, USFS, and USFWS in compliance with the ESA. The consultation covers proposed federal projects for the FY 2004 through 2008 period for federally managed lands in southwest Oregon. Discussions relating to spotted owls include wildfire impacts, Critical Habitat, and Incidental Take.

The full text of the Biological Opinion is available on the internet at www.or.blm.gov/medford/planning/planningdocs.htm

The intent of this appendix section is to provide ready access to sections of the BO that relate to BLM's responses to public comments on the Timbered Rock DEIS regarding spotted owls. NRF refers to nesting, roosting, foraging habitat (suitable habitat for owls). CHU is critical habitat unit, as designated by USFWS in 1992.

From Table 1 Proposed Action
Page 6. A: Tree harvest in nesting, roosting, foraging habitat.

"Up to 3,000 acres of salvage may occur in the Timbered Rock Fire area, all in LSR. None of these salvage acres would be habitat for listed species."

Page 6. B: Vegetation Management:

"Precommercial thinning/ brushing/ site preparation: BLM 12,700 acres/year. FS 4,000 acres/year. Up to 20 percent within LSRs."

Page 7. E: Fuels Management.

"BLM 15,000 acres of mechanical or hand fuels reduction/yr."

Page 11. E. Fuels Management:

"Natural and created fuel breaks across the landscape may be developed to help with the suppression of large-scale wildfires. In this case, treatment of fuels along a ridge or topographic break would occur to reduce the fuels and facilitate suppression activities."

Federal Contribution to Recovery

Page 27:

"The NWFP is the current conservation strategy for the spotted owl on federal lands."

"The range-wide system of LSRs set up under the NWFP captures the variety of ecological conditions within the 12 different physiographic provinces to which spotted owls are adapted. This design reduces the potential for loss of the entire population due to large catastrophic events in a single province. Multiple, large LSRs in each province reduce the potential that spotted owls will be lost in any individual province and reduce the potential that large wildfires or other events will eliminate all habitat within an LSR. In addition, LSRs are generally arranged and spaced so that spotted owls may disperse to two or more adjacent LSRs."

Conservation Strategy and Objectives

Page 32:

"CHUs were intended to identify a network of habitats that provided the functions considered important to maintaining a stable, self-sustaining, and interconnected population over the spotted owl range, with each CHU having a local, provincial, and a range-wide role in spotted owl conservation."

"The Service's approach to designated critical habitat was based on the expectation that a long-term plan would be developed to provide for conservation of the spotted owl." "The final rule designating critical habitat stated that … 'designation of critical habitat does not offer specific direction for managing owl habitat'."

"The NWFP, which adopts coordinated management direction for federal lands within the range of the spotted owl, represents the only existing management plan that addresses conservation of the spotted owl on federal lands."

Page 33:

"Despite the fact that there is extensive overlap [70%] between CHU and LSRs, CHUs are more evenly distributed across the landscape. Thus, connectivity may be the most important ongoing function of critical habitat. This would be

particularly true in areas where the risk of habitat loss from wildfire is high."

Current Condition

Page 34:

"Although habitat quality within these CHUs [including OR-34 Elk Creek] has been reduced to some degree, due to the amount and distribution of remaining suitable habitat, the dispersed nature of effects, and the retention of dispersal habitat within CHUs …OR-34 …it is anticipated that these CHUs are still functioning in their originally intended capacity…"

"Notwithstanding that many of the CHUs in the Oregon Klamath Mountain and Western Oregon Cascades Provinces have been impacted to some degree and the majority of consulted-on effects have occurred in these provinces, total consulted-on effects in these provinces represents only 3.28 and 2.21 percent of their suitable critical habitat extant in 1994, respectively." "The Service believes that these effects to connectivity are generally offset because of contributions to connectivity provided by other NWFP LUAs and Standard and Guidelines (i.e. the 15 percent LS/OG standard and guideline, survey and manage set-aside guidelines, and riparian reserves)."

Page 35:

"The impact of natural events also needs to be considered when evaluating the current condition of spotted owl critical habitat. Since its designation in 1992, numerous fires of different scale and intensity have occurred within CHUs. Critical habitat units were identified to provide large blocks of suitable habitat spatially distributed to provide for the survival and recovery of the spotted owl and to facilitate dispersal. The distribution framework of CHUs was intended to protect individual CHUs from isolation due to catastrophic natural events."

Page 36:

"…effects since 1994 have impaired, to varying degrees, the ability of individual CHUs to fulfill their intended functions. However, these effects have not precluded the CHU network from providing for NSO conservation across the species range." "…notwithstanding that natural disturbances have resulted in the removal and degradation of large blocks of suitable habitat and reduced the resilience of the CHU network to future effects, they have not precluded the CHU network from functioning within any province…"

Spotted Owl Critical Habitat – environmental baseline

Page 61:

"Two other CHUs suffered significant losses of habitat due to fires. OR-34 is located on the Medford District BLM and Rogue River NF. Seventy-four percent of the unit is within the Elk Creek and Lookout Mt/Black Butte LSRs. This unit was designated to maintain the essential nesting, roosting, foraging, and dispersal habitats found in this region of high fragmentation, due primarily because of land ownership patterns…" "This CHU provides north-south and east-west linkage from the Klamath/Siskiyou to the Western Cascades Provinces. The 2002 Timber Rock Fire occurred in this CHU." "This remaining NRF should continue to provide for essential spotted owl habitat within the CHU." "… there is available dispersal habitat within most federal sections of at least 60 percent or better along both the northern and western portion of the CHU which should continue to provide dispersal opportunities in a northeast southwest direction across this CHU and along the Rogue/Umpqua divide." The other CHU referenced is the Quartz fire.

Page 63:

"Therefore, even with the loss of eleven percent of the available NRF from CHUs in the action area from both fires and timber harvest since 1996, the critical habitat network in the Rogue and South Coast basins are currently functioning as intended. The amount and distribution of dispersal habitat currently existing within these CHUs should allow for movement of spotted owls through and between these CHUs and important inter- and intra-provincial links provided by these CHUs should still be functioning."

Effects of the Action

Pages 66 and 67:

"In addition, there may be significant amount of salvage that will occur in both the Biscuit and Timbered Rock fires. This salvage is generally limited to completely burned stands larger than ten acres and is not considered to be NRF post-fire. The salvage of this non habitat should have little effect on spotted owls as there is little to no canopy closure, no live trees, and likely a much reduced prey population, at least in the short term. However, it is largely unknown how spotted owls respond to fire and there may be some potential for adverse impacts to spotted owls due to disturbance or effects to spotted owls potentially using these burned areas or areas immediately adjacent to the burned areas. Specifically, there is

a research project proposed within the Timbered Rock Fire perimeter that will study the role of standing and down large wood levels on neotropical migratory bird populations and up to 100 acres of the proposed treatment units may occur within or adjacent to historic spotted nest sites that were burned in the fire. The Service believes that while these acres are completely burned and not currently considered habitat, there is some potential for owls to be associated with or near to these research plots and this research project will may affect and is likely to adversely affect the spotted owl. This adverse affect could result in the potential loss of forage and/or nesting habitat if the owls that had been using this habitat before the fire return [to] these sites and this loss could result in the injury or death of those spotted owls."

Page 69:

"Also, with the human and fire induced reductions of spotted owl habitat over time, spotted owls may have been forced to find nest sites closer to other spotted owls than historically occurred."

Pages 69 and 70:

"Projects that degrade NRF in LSRs are also generally designed to open up stands that, while they may meet the minimum size standard for spotted owl habitat, but are generally single-storied and monotypic. In such cases, timber harvest is an effort to introduce complexity into the landscape and bring these stands forward sooner into higher quality late-successional condition than would occur naturally. These projects may have a short-term, negative impact on the quality of the spotted owl habitat in LSRs, but are designed to produce higher quality NRF more quickly than would be reached without treatment, given existing conditions. These projects must be consistent with REO direction including the tree thinning in LSRs memoranda…" "…any project that removes, degrades or slows the development of spotted owl habitat within an LSR is reviewed, and approved, by the Level One team for consistency with this Opinion (and , therefore, with the NWFP)…"

Dispersal Habitat

Page 70:

"In addition to the removal of spotted owl NRF, 2,545 and 705 acres of spotted owl dispersal habitat may be degraded and removed in LSRs, respectively. These impacts are also designed to speed the development of spotted owl habitat, to reduce the potential for catastrophic fire or to reduce encroachment within meadow habitat …"

"Since the service anticipates that the 2,048 acres of degraded dispersal habitat will still function as dispersal habitat post-harvest, we do not anticipate that the impact to the spotted owl from the degradation of these acres will adversely impact the local spotted owl population."

Connectivity (the watershed containing Timbered Rock)

Pages 74 and 75:

"The Rogue Upper watershed may, under the proposed action, experience the removal of 771 acres of NRF and the removal of 889 acres of dispersal habitat, which is 0.5 percent of the watersheds extant dispersal or better habitat…" "This watershed includes CHU … OR-34...; timber harvest would remove 190 acres of spotted owl habitat from CHU OR-34. Dispersal analyses by the agencies show that the watershed is currently at 70 percent dispersal habitat on federal lands and the proposed action may only reduce dispersal habitat by 1 percent. In addition, the dispersal map also shows sufficient dispersal habitat at this time to facilitate dispersal along the south Cascades and west into the Galesville I-5 area of concern … and this watershed will not be reduced to below 50 percent dispersal habitat by the proposed action." "The proposed action is not expected to preclude spotted owl dispersal from the Cascades to the Siskiyous and the Coast ranges in this area."

Spotted Owl Critical Habitat

Page 77:

The 0.8 percent of the extant NRF (190 acres) that is proposed to be removed from OR-34 affects a CHU that was impacted by the Timbered Rock Fire." "This CHU should continue to provide north-south and east-west linkage from the Klamath Siskiyou to the Western Cascades Provinces." "The remaining 20,832 acres of NRF remaining in this CHU should provide sufficient NRF for the known spotted owls within the CHU and also continue to provide dispersal habitat for spotted owls in both N-S and E-W directions. While there will be adverse effects to this CHU in the form of NRF loss or downgrading, the Service does not believe that the proposed action will preclude the ability of this CHU to function as intended."

Incidental Take Statement for Owls

Page 105:

> "Tthe Service anticipates that the proposed action could result in incidental take of all spotted owls associated with the removal and downgrading of 31,261 acres of suitable spotted owl habitat from tree harvest and other activities …" "In southwest Oregon and the Klamath range in particular, the extant habitat is naturally fragmented and it is therefore likely that any available habitat is being used by spotted owls."

> "The Service also anticipates the take of any owls associated with up to 100 acres of proposed research units that may occur within or adjacent to historic and potentially extant spotted [owl] nest sites within the Timbered Rock Fire. The Service believes that while these acres are completely burned and not currently considered habitat, it is largely unknown how owls respond to fire, there is some potential for owls to be associated with or near to these research lots and this research project has the potential to take one or more of these birds."

Appendix O
Roads

Table O-1. Transportation Management Objectives (TMO)

Road And Segment Number	Length (miles)	Surface Type	Recommended Treatment	Control	Alternative					
					B	C	D	E	F	G
32 S 01 E 03.00	0.44	NAT	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 E 03.01	0.47	NAT	Partial Decomm	BLM	x	x	x	x	x	x
32 S 01 E 07.00	0.20	PRR	Full Decomm	BLM	x	x	x	x		x
32 S 01 E 07.01	1.24	ABC	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 07.02	0.48	ABC	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 07.03	0.33	ABC	Improve	BLM	x	x	x	x	x	x
32 S 01 E 07.03	0.26	ABC	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 07.04	0.27	ABC	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 08.00A	0.19	ABC	Improve	BLM	x	x	x	x	x	x
32 S 01 E 08.01	0.20	ABC	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 E 09.00A1	0.20	ABC	Improve	BLM	x	x	x	x	x	x
32 S 01 E 09.00A2	0.27	ABC	Improve	BLM	x	x	x	x	x	x
32 S 01 E 09.00A3	0.38	ABC	Improve	BLM	x	x	x	x	x	x
32 S 01 E 09.01A	0.51	ABC	Improve	BLM	x	x	x	x	x	x
32 S 01 E 09.01B1	0.47	ABC	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 09.01B2	0.22	ABC	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 09.01C	0.40	NAT	Renovate	PVT	x	x	x	x	x	x
32 S 01 E 09.02	0.44	ABC	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 E 09.03	0.30	ABC	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 E 09.04	0.32	ABC	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 09.05	0.31	ABC	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 10.00B	0.10	NAT	Renovate	BLM				x		
32 S 01 E 10.00D	0.06	NAT	Renovate	BLM				x		
32 S 01 E 10.01A	0.29	ABC	Improve	BLM	x	x	x	x	x	x
32 S 01 E 10.01B1	0.61	ABC	Improve	BLM	x	x	x	x	x	x
32 S 01 E 10.01B2	0.98	ABC	Improve	BLM	x	x	x	x	x	x
32 S 01 E 10.01B3	0.51	ABC	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 E 10.03B	1.39	NAT	Full Decomm/Renovate/ Gate	BLM	x	x	x	x		x
32 S 01 E 10.03B	0.51	NAT	Renovate/Full Decomm/ Gate	BLM	x	x	x	x		x
32 S 01 E 10.04B	2.14	NAT	Improve	BLM	x	x	x	x	x	x
32 S 01 E 10.05	0.35	NAT	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 E 11.00A	0.71	ASC	Renovate	BLM				x		
32 S 01 E 11.00B	0.47	NAT	Partial Decomm	BLM	x	x	x	x		x
32 S 01 E 11.01	0.84	ABC	Renovate	BLM				x		
32 S 01 E 11.02A	0.60	ABC	Renovate	BLM				x		
32 S 01 E 11.02B	0.18	ABC	Full Decomm	BLM				x		
32 S 01 E 11.03A	0.35	ABC	Renovate	BLM				x		
32 S 01 E 11.04A	0.68	BST	Renovate	BLM				x		
32 S 01 E 13.00A	0.03	NAT	Renovate	BLM				x		
32 S 01 E 13.01A1	1.91	ABC	Renovate	BLM				x		
32 S 01 E 13.01B	0.10	NAT	Renovate	BLM				x		
32 S 01 E 13.02A	0.91	ABC	Renovate	BLM				x		
32 S 01 E 13.02B	1.27	ABC	Full Decomm	BLM	x	x	x	x		x

Table O-1. Transportation Management Objectives (TMO)

Road And Segment Number	Length (miles)	Surface Type	Recommended Treatment	Control	Alternative					
					B	C	D	E	F	G
32 S 01 E 13.02B(ST)	0.13	ABC	Full Decomm	BLM	x	x	x	x		x
32 S 01 E 13.03	0.41	NAT	Renovate	BLM				x		
32 S 01 E 13.04	0.26	GRR	Full Decomm	BLM				x		
32 S 01 E 13.05	0.09	ABC	Full Decomm	BLM				x		
32 S 01 E 13.06	0.15	ABC	Renovate	BLM				x		
32 S 01 E 13.07	0.24	ABC	Full Decomm	BLM				x		
32 S 01 E 15.00A	0.18	NAT	Renovate/Temp.Close	BLM	x	x	x	x	x	x
32 S 01 E 15.00B	0.77	ABC	Improve/Temp.Close	BLM	x	x	x	x	x	x
32 S 01 E 15.01	0.86	ABC	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 E 15.02	0.97	ABC	Partial Decomm	BLM	x	x	x	x	x	x
32 S 01 E 15.03	0.58	ABC	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 15.04	0.28	ABC	Partial Decomm	BLM	x	x	x	x	x	x
32 S 01 E 15.05	0.29	ABC	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 E 15.06	0.95	ABC	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 16.00B	0.55	NAT	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 16.01B	0.11	NAT	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 E 16.02B	0.16	NAT	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 E 17.00	0.47	NAT	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 E 17.01	0.15	NAT	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 17.02	0.39	NAT	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 E 17.03	0.31	NAT	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 E 17.04A	0.72	ASC	Improve	BLM	x	x	x	x	x	x
32 S 01 E 17.04B	0.42	PRR	Improve	BLM	x	x	x	x	x	x
32 S 01 E 17.04C	1.54	PRR	Improve	BLM	x	x	x	x	x	x
32 S 01 E 17.05A1	0.47	ABC	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 17.05A2	0.37	ABC	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 17.05B	1.01	PRR	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 E 17.05C	0.13	NAT	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 E 17.06	0.33	PRR	Renovate/Temp.Close	BLM	x	x	x	x	x	x
32 S 01 E 17.07	0.41	NAT	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 E 17.08	0.31	NAT	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 17.09	0.09	NAT	Renovate/Temp.Close	BLM	x	x	x	x	x	x
32 S 01 E 18.00A	0.65	ABC	Improve	BLM	x	x	x	x	x	x
32 S 01 E 18.00B	0.09	ABC	Improve	BLM	x	x	x	x	x	x
32 S 01 E 18.00C	0.83	NAT	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 E 18.01E	0.19	NAT	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 18.02B	0.68	ABC	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 18.03	0.48	NAT	Renovate/Temp.Close	BLM	x	x	x	x	x	x
32 S 01 E 19.00	0.69	ABC	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 E 19.01	0.83	ABC	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 E 19.02	0.18	ABC	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 19.04A	0.25	NAT	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 E 20.00B	1.35	ABC	Improve	BLM	x	x	x	x	x	x
32 S 01 E 20.00C	0.40	ABC	Renovate/Temp.Close	BLM	x	x	x	x	x	x

Table O-1. Transportation Management Objectives (TMO)

Road And Segment Number	Length (miles)	Surface Type	Recommended Treatment	Control	Alternative					
					B	C	D	E	F	G
32 S 01 E 20.00E	0.85	ABC	Renovate/Temp.Close	BLM	x	x	x	x	x	x
32 S 01 E 20.00E(ST)	1.15	ABC	Renovate/Temp.Close	BLM	x	x	x	x	x	x
32 S 01 E 20.01A	0.66	ASC	Improve	PB	x	x	x	x	x	x
32 S 01 E 20.01B	0.68	ABC	Improve	PB	x	x	x	x	x	x
32 S 01 E 20.01C	1.41	ABC	Improve	BLM	x	x	x	x	x	x
32 S 01 E 20.01ext.D	0.01	ABC	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 E 20.02B	0.50	NAT	Improve	BLM	x	x	x	x	x	x
32 S 01 E 20.03B	0.61	ABC	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 E 20.04B	0.18	NAT	Improve/Temp.Close	BLM	x	x	x	x	x	x
32 S 01 E 20.04D	0.04	NAT	Improve/Temp.Close	BLM	x	x	x	x	x	x
32 S 01 E 20.04F	0.76	NAT	Improve/Temp.Close	BLM	x	x	x	x	x	x
32 S 01 E 20.05B	1.40	ABC	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 21.00D	0.29	NAT	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 22.00A	1.34	PRR	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 22.00B2	0.27	PRR	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 22.00C	0.73	PRR	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 22.00D	0.59	PRR	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 23.00A	1.11	BST	Improve	BLM	x	x	x	x	x	x
32 S 01 E 23.00B1	0.06	BST	Improve	BLM	x	x	x	x	x	x
32 S 01 E 23.00B2	0.53	BST	Improve	BLM	x	x	x	x	x	x
32 S 01 E 23.00C	1.14	ABC	Renovate	PB	x	x	x	x	x	x
32 S 01 E 23.00D1	0.90	ABC	Improve	BLM	x	x	x	x	x	x
32 S 01 E 23.00D2	0.21	ABC	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 23.00F	0.42	PRR	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 E 23.05D	0.62	ASC	Renovate/Temp.Close	BLM				x		
32 S 01 E 26.00	0.60	NAT	Partial Decomm	BLM				x		
32 S 01 E 27.00A	0.66	BST	Improve	BLM	x	x	x	x	x	x
32 S 01 E 27.00C	0.02	ABC	Improve	PB	x	x	x	x	x	x
32 S 01 E 27.00D	1.30	ASC	Improve	PB	x	x	x	x	x	x
32 S 01 E 27.00E	0.84	ASC	Improve	BLM	x	x	x	x	x	x
32 S 01 E 27.00G	0.26	NAT	Renovate/Temp.Close	BLM	x	x	x	x	x	x
32 S 01 E 27.01	0.11	NAT	Full Decomm	BLM				x		
32 S 01 E 29.00	0.43	NAT	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 29.01A1	0.37	ASC	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 29.01A2	0.58	ASC	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 29.01B	0.19	ABC	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 E 29.01B(DR)	0.22	ABC	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 E 29.02A	0.40	ABC	Renovate	PB	x	x	x	x	x	x
32 S 01 E 29.02B1	0.41	ABC	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 29.02B2	0.38	ABC	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 29.03A	0.21	NAT	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 E 29.04	0.13	NAT	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 E 29.04	0.18	NAT	Improve	BLM	x	x	x	x	x	x
32 S 01 E 30.01A	0.13	NAT	Renovate	BLM	x	x	x	x	x	x

Table O-1. Transportation Management Objectives (TMO)

Road And Segment Number	Length (miles)	Surface Type	Recommended Treatment	Control	Alternative					
					B	C	D	E	F	G
32 S 01 E 30.01B	0.26	NAT	Full Decomm/Renovate	BLM	x	x	x	x	x	x
32 S 01 E 30.01B	0.09	NAT	Renovate/Full Decomm	BLM	x	x	x	x	x	x
32 S 01 E 31.01	0.45	NAT	Renovate/Temp.Close	BLM	x	x	x	x	x	x
32 S 01 E 33.00B	0.12	NAT	Renovate	BLM	x	x	x	x	x	x
32 S 01 E 33.00C	0.23	NAT	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 E 33.03A	0.28	NAT	Improve/remove odd pipe	BP	x	x	x	x	x	x
32 S 01 E 35.00A	0.50	ABC	Renovate	BLM				x		
32 S 01 E 35.00B	1.96	ABC	Renovate	BLM				x		
32 S 01 E 35.00 tie rd	0.66	NAT	Full Decomm	BLM	x	x	x	x		x
32 S 01 E 35.02A	0.39	ABC	Renovate	BLM				x		
32 S 01 E 35.02B	0.31	NAT	Renovate	BLM				x		
32 S 01 E 35.03	0.63	ABC	Full Decomm	BLM				x		
32 S 01 E 35.07	0.19	NAT	Full Decomm	BLM				x		
32 S 01 E 35.09A	0.31	NAT	Renovate	BLM				x		
32 S 01 W 11.01	0.12	NAT	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 W 12.00	2.27	ABC	Renovate	BLM	x	x	x	x	x	x
32 S 01 W 12.01	0.86	ABC	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 W 12.02	0.18	ABC	Partial Decomm	BLM	x	x	x	x	x	x
32 S 01 W 12.03	0.09	NAT	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 W 13.00A	0.91	ABC	Renovate/Temp.Close	BLM	x	x	x	x	x	x
32 S 01 W 13.00B	3.43	ABC	Renovate/Temp.Close	BLM	x	x	x	x	x	x
32 S 01 W 13.01	0.45	ABC	Full Decomm/Renovate	BLM	x	x	x	x	x	x
32 S 01 W 13.01	0.08	ABC	Renovate/Full Decomm	BLM	x	x	x	x	x	x
32 S 01 W 13.03	0.18	NAT	Full Decomm	BLM	x	x	x	x		x
32 S 01 W 23.00	0.38	ASC	Full Decomm/Renovate	BLM	x	x	x	x		x
32 S 01 W 23.00	1.10	ASC	Renovate/Full Decomm	BLM				x		
32 S 01 W 23.02A	1.00	ASC	Renovate	BLM	x	x	x	x		x
32 S 01 W 23.02B	0.65	ASC	Renovate	PB	x	x	x	x		x
32 S 01 W 23.02C1	0.30	ASC	Renovate	BLM	x	x	x	x		x
32 S 01 W 23.02C2	0.56	ASC	Renovate	BLM	x	x	x	x		x
32 S 01 W 23.03	0.32	ASC	Full Decomm	BLM	x	x	x	x		x
32 S 01 W 23.04	0.66	PRR	Renovate	BLM	x	x	x	x	x	x
32 S 01 W 23.05	0.04	ASC	Renovate	BLM	x	x	x	x		x
32 S 01 W 23.05	0.46	ASC	Full Decomm	BLM	x	x	x	x		x
32 S 01 W 23.06	0.63	ASC	Partial Decomm	BLM				x		
32 S 01 W 25.00	0.19	ABC	Partial Decomm	BLM	x	x	x	x	x	x
32 S 01 W 25.01	0.34	ABC	Renovate/Temp.Close	BLM	x	x	x	x	x	x
32 S 01 W 25.02	0.20	NAT	Full Decomm/Ren/gate	BLM	x	x	x	x	x	x
32 S 01 W 25.02	0.32	NAT	Renovate/gate/Full Decomm	BLM	x	x	x	x	x	x
32 S 01 W 25.03	0.63	NAT	Full Decomm	BLM	x	x	x	x		x
32 S 01 W 26.00A	0.53	ASC	Renovate	BLM	x	x	x	x	x	x

Table O-1. Transportation Management Objectives (TMO)

Road And Segment Number	Length (miles)	Surface Type	Recommended Treatment	Control	Alternative					
					B	C	D	E	F	G
32 S 01 W 26.00B	0.54	ASC	Renovate	BLM	x	x	x	x	x	x
32 S 01 W 26.00C	1.60	ASC	Renovate	BLM	x	x	x	x	x	x
32 S 01 W 26.00D	1.10	ASC	Renovate	BLM				x		
32 S 01 W 26.00F	0.03	ASC	Renovate	BLM				x		
32 S 01 W 26.01	1.89	ASC	Renovate	BLM				x		
32 S 01 W 26.02B	0.19	NAT	Full Decomm	BLM	x	x	x	x		x
32 S 01 W 26.02B	0.06	NAT	Renovate	BLM	x	x	x	x		x
32 S 01 W 26.04A	0.56	ASC	Renovate	PB	x	x	x	x	x	x
32 S 01 W 26.04B	0.41	ASC	Renovate	BLM	x	x	x	x	x	x
32 S 01 W 26.05A	0.04	ASC	Renovate	PB	x	x	x	x	x	x
32 S 01 W 26.05B	0.86	ASC	Full Decomm/Renovate	BLM	x	x	x	x	x	x
32 S 01 W 26.05B	0.75	ASC	Renovate/Full Decomm	BLM	x	x	x	x	x	x
32 S 01 W 26.06B	0.12	ABC	Full Decomm	BLM				x		
32 S 01 W 26.07A	0.43	ASC	Renovate	BLM				x		
32 S 01 W 26.07B	0.28	ABC	Renovate	BLM				x		
32 S 01 W 26.08	0.77	ABC	Full Decomm	BLM	x	x	x	x	x	x
32 S 01 W 26.09	0.20	ABC	Full Decomm/Improve	BLM	x	x	x	x	x	x
32 S 01 W 26.09	0.40	ABC	Improve/Full Decomm	BLM	x	x	x	x	x	x
32 S 01 W 27.00	0.37	PRR	Renovate	BLM				x		
32 S 01 W 27.01	0.30	ABC	Full Decomm	BLM	x	x	x	x		x
32 S 01 W 27.02	0.36	ABC	Full Decomm	BLM	x	x	x	x		x
32 S 01 W 27.02SPUR1	0.10	NAT	Full Decomm	BLM	x	x	x	x		x
32 S 01 W 27.03	0.37	ABC	Partial Decomm	BLM				x		
32 S 01 W 34.00	0.42	ABC	Renovate	BLM				x		
32 S 01 W 34.01	0.40	ABC	Full Decomm	BLM	x	x	x	x		x
32 S 01 W 35.00A	0.97	ASC	Full Decomm	BLM	x	x	x	x		x
32 S 01 W 35.00B	0.24	ASC	Full Decomm	BLM	x	x	x	x		x
32 S 01 W 35.00B_B	1.09	ASC	Renovate	BLM				x		
32 S 01 W 35.01	0.48	ABC	Full Decomm	BLM	x	x	x	x		x
32 S 01 W 35.02	1.56	PRR	Renovate/Temp.Close	BLM				x		
32 S 01 W 35.02_	0.30	PRR	Full Decomm	BLM	x	x	x	x		x
32 S 01 W 35.04	0.58	ABC	Full Decomm	BLM	x	x	x	x		x
32 S 01 W 35.07A	0.10	ASC	Full Decomm	BLM	x	x	x	x		x
32 S 01 W 35.07B	0.03	NAT	Full Decomm	BLM	x	x	x	x		x
32 S 01 W 35.07B(CL)	0.18	NAT	Full Decomm	BLM	x	x	x	x		x
32 S 01 W 36.01	1.47	ASC	Renovate	BLM	x	x	x	x	x	x
32 S 01 W 36.02	0.25	NAT	Full Decomm	BLM	x	x	x	x	x	x
32 S 02 E 18.00A1	0.17	ASC	Renovate	PB				x		
32 S 02 E 18.00A2	0.22	ASC	Renovate	PB				x		
32 S 02 E 18.00A3	0.35	ASC	Renovate	PB				x		
32 S 02 E 18.00B	0.09	ASC	Renovate	PB				x		

Table O-1. Transportation Management Objectives (TMO)

Road And Segment Number	Length (miles)	Surface Type	Recommended Treatment	Control	Alternative					
					B	C	D	E	F	G
32 S 02 E 18.01	1.09	ASC	Renovate/Temp.Close	BLM				x		
32 S 02 E 18.02	0.33	ASC	Renovate/Temp.Close	BLM				x		
32S 01 W 35.05	1.21	ABC	Partial Decomm	BLM				x		
32S 01 W 35.06	0.31	ABC	Full Decomm	BLM	x	x	x	x	x	x
33 S 01 E 03.00	0.16	NAT	Full Decomm	BLM				x		
33 S 01 E 04.00A	0.54	NAT	Renovate	BLM	x	x	x	x	x	x
33 S 01 E 04.00C	0.34	NAT	Renovate	PB	x	x	x	x	x	x
33 S 01 E 04.00D	0.81	ASC	Renovate	PB	x	x	x	x	x	x
33 S 01 E 04.00E	0.98	ASC	Renovate	BLM	x	x	x	x	x	x
33 S 01 E 04.00F	0.19	ASC	Renovate	PB	x	x	x	x	x	x
33 S 01 E 04.00G1	0.76	ASC	Renovate	BLM	x	x	x	x	x	x
33 S 01 E 04.00G2	0.96	ABC	Full Decomm	BLM	x	x	x	x	x	x
33 S 01 E 04.00H	0.61	ABC	Renovate	BLM	x	x	x	x	x	x
33 S 01 E 05.00B	0.21	NAT	Full Decomm	BLM	x	x	x	x	x	x
33 S 01 E 05.01A1	0.35	ABC	Improve	BLM	x	x	x	x	x	x
33 S 01 E 05.01A2	0.18	ABC	Improve	BLM	x	x	x	x	x	x
33 S 01 E 05.01B	0.35	ABC	Renovate	PB	x	x	x	x	x	x
33 S 01 E 05.01C	0.06	NAT	Full Decomm	BLM	x	x	x	x	x	x
33 S 01 E 05.02	0.31	ABC	Full Decomm	BLM	x	x	x	x	x	x
33 S 01 E 06.00	0.17	PRR	Full Decomm	BLM				x		
33 S 01 E 06.01	0.14	PRR	Full Decomm	BLM	x	x	x	x	x	x
33 S 01 E 07.01A	0.05	PRR	Full Decomm	BLM	x	x	x	x	x	x
33 S 01 E 07.01C	0.31	PRR	Renovate	BLM	x	x	x	x	x	x
33 S 01 E 07.02A	0.26	NAT	Renovate	PB				x		
33 S 01 E 07.02C	0.08	NAT	Renovate	BLM				x		
33 S 01 E 07.03B	0.34	NAT	Full Decomm	BLM	x	x	x	x	x	x
33 S 01 E 07.04	0.56	ABC	Improve	BLM	x	x	x	x	x	x
33 S 01 E 07.05	0.34	ABC	Full Decomm	BLM				x		
33 S 01 E 07.06	0.23	ABC	Full Decomm	BLM	x	x	x	x	x	x
33 S 01 E 08.00A	0.22	PRR	Renovate	BLM	x	x	x	x	x	x
33 S 01 E 08.00B	0.21	PRR	Improve	BLM	x	x	x	x	x	x
33 S 01 E 08.00C	1.10	PRR	Improve	BLM	x	x	x	x	x	x
33 S 01 E 08.00D	0.14	NAT	Improve	BLM	x	x	x	x	x	x
33 S 01 E 17.00A	0.84	BST	Renovate	BLM	x	x	x	x	x	x
33 S 01 E 17.00B	1.12	BST	Renovate	BLM	x	x	x	x	x	x
33 S 01 E 17.00C	1.53	BST	Renovate	BLM	x	x	x	x	x	x
33 S 01 E 17.00D	1.21	BST	Renovate	BLM	x	x	x	x	x	x
33 S 01 E 17.01A1	0.60	PRR	Renovate	BLM	x	x	x	x	x	x
33 S 01 E 17.01B1	0.12	PRR	Renovate	BLM	x	x	x	x	x	x
33 S 01 E 17.01B2	0.70	PRR	Full Decomm	BLM	x	x	x	x	x	x
33 S 01 E 18.00	0.63	ABC	Full Decomm	BLM	x	x	x	x	x	x
33 S 01 E 27.00M	0.91	ABC	Renovate	BLM				x		
33 S 01 E 27.00N	0.48	ABC	Renovate	BLM				x		

Table O-1. Transportation Management Objectives (TMO)

Road And Segment Number	Length (miles)	Surface Type	Recommended Treatment	Control	Alternative					
					B	C	D	E	F	G
33 S 01 E 27.00O	0.36	NAT	Renovate	BLM				x		
33 S 01 E 30.00	2.75	NAT	Full Decomm	BLM	x	x	x	x		x
33 S 01 W 02.00	0.52	ASC	Renovate	BLM				x		
33 S 01 W 02.01	0.06	ASC	Full Decomm	BLM	x	x	x	x		x
33 S 01 W 03.01	0.59	NAT	Full Decomm	BLM				x		
33 S 01 W 03.02	0.10	NAT	Full Decomm	BLM				x		
33 S 01 W 03.03	0.15	NAT	Full Decomm	BLM				x		
33 S 01 W 08.00B	0.38	ABC	Renovate	BLM				x		
33 S 01 W 08.00C	0.69	ABC	Improve	BLM				x		
33 S 01 W 08.00C	0.61	ABC	Renovate	BLM				x		
33 S 01 W 08.00D	2.32	ABC	Improve	BLM				x		
33 S 01 W 08.00E	1.51	ABC	Renovate	BLM				x		
33 S 01 W 10.00A	1.30	ASC	Renovate	BLM				x		
33 S 01 W 10.00B	0.89	ASC	Renovate	BLM				x		
33 S 01 W 10.00C	1.41	ASC	Renovate	BLM				x		
33 S 01 W 10.00D	2.18	ABC	Renovate	BLM				x		
33 S 01 W 11.00	0.31	NAT	Full Decomm	BLM	x	x	x	x		x
33 S 01 W 11.01	0.91	PRR	Full Decomm	BLM	x	x	x	x		x
33 S 01 W 12.00	1.38	PRR	Improve/Temp.Close	BLM				x		
33 S 01 W 12.00 spur1	0.14	NAT	Full Decomm	BLM				x		
33 S 01 W 12.00 spur2	0.06	NAT	Full Decomm	BLM				x		
33 S 01 W 12.01	0.42	PRR	Renovate/Temp.Close	BLM				x		
33 S 01 W 12.02	0.91	PRR	Full Decomm	BLM	x	x	x	x		x
33 S 01 W 12.03	0.95	PRR	Full Decomm	BLM	x	x	x	x		x
33 S 01 W 14.00	0.19	NAT	Renovate	BLM	x	x	x	x		x
33 S 01 W 14.00	0.71	NAT	Full Decomm	BLM	x	x	x	x		x
33 S 01 W 14.00 spur1	0.17	NAT	Full Decomm	BLM	x	x	x	x		x
33 S 01 W 14.01A	0.17	GRR	Renovate	BLM				x		
33 S 01 W 14.01B	0.79	GRR	Renovate	BLM				x		
33 S 01 W 14.02	0.58	NAT	Full Decomm	BLM	x	x	x	x		x
33 S 01 W 15.00	0.44	NAT	Full Decomm	BLM				x		
33 S 01 W 15.01	0.55	NAT	Full Decomm	BLM				x		

NAT-Natural Surface; BST-Bituminous Surface Treatment; ASC-Aggregate Surface Coarse; PRR-Pit Run Rock; ABC-Aggregate Base Coarse